THE NATIONAL GEOGRAPHIC MAGAZINE

Vol. XII JUNE, 1901 No. 6

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THE POPULAR SCIENCE MONTHLY for June opens with an article by Prof. J. W. Tuomey, of the newly established Yale Forest School, on the forest reservations of the United States. The importance of these great reservations for the future of the country is scarcely appreciated, and this article, with its beautiful illustrations, will call attention to these national parks, whose area is more than fifteen times the State of Connecticut. Another elaborately illustrated article in the number is one by Professor Francis H. Herrick, of Adelbert College, describing his newly discovered method of photographing and studying birds at arm's length. Dr. David Starr Jordan, President of Stanford University, contributes a study of the decay of races through the survival of the unfit, arguing that war weakens the nation by destroying its best material. Professor Robert H. Thurston, Director of Sibley College, Cornell University, traces the progress and tendency of mechanical engineering during the nineteenth century. Professor James Lewis Howe, of Washington and Lee University, contributes an article on the periodic law, a scientific generalization, the importance of whcih is ranked with the law of gravitation or the theory of evolution, yet regarding which many intelligent people are not informed. Mr. Havelock Ellis continues his study of British men of genius, tracing their marriage and family and the age to which they lived. An address by the late Professor Henry A. Rowland, of the Johns Hopkins University, entitled "A Plea for Pure Science," points out the defects and needs of science in America. Dr. Gary N. Calkins, of Columbia University, describes the malaria-bearing parasite by means of which the mosquito spreads this disease, the most important scientific advance since the discovery of the Röntgen Rays. The number, as usual, closes with short notes describing the most recent progress of science.

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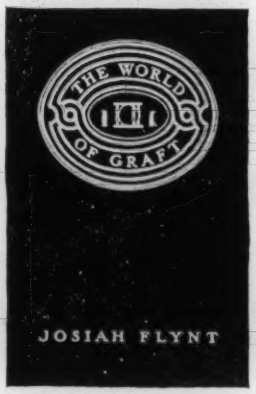

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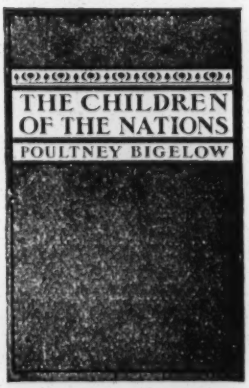

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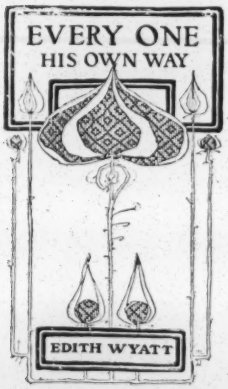

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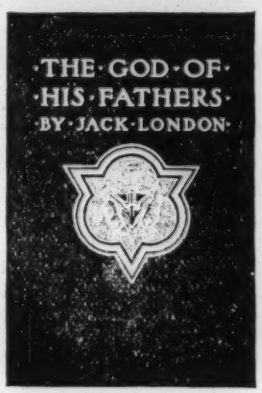

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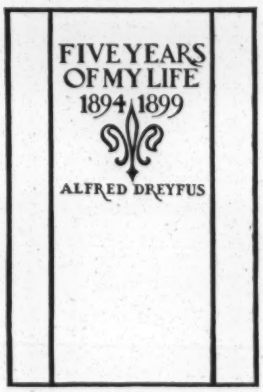

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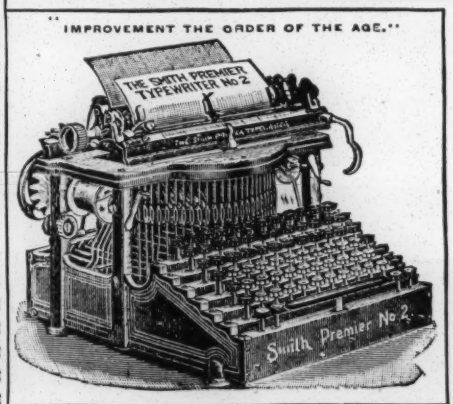

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VOL. XII, No. 6 WASHINGTON JUNE, 1901

THE NATIONAL GEOGRAPHIC MAGAZINE

CHINA: HER HISTORY AND DEVELOPMENT

BY JOHN BARRETT, FORMERLY MINISTER TO SIAM

MYTHOLOGY plays an important part in the ancient history of China, as it does in that of the older European nations. Going back to the fabulous times of 500,000 to 1,000,000 years, it first begins to tell a story of some truth about thirty-three centuries before Christ. Fuh-hi, who reigned 2900 B. C., is commonly regarded as the first real man whose name stands out in the long dim line of ancient kings. Before him as a human monarch were ages of supernatural giants. There was Pwan-ku, who formed cosmos from chaos. For 18,000 years he labored chiseling into definite form the rude, shapeless earth. He was followed by three sovereigns who, during another period of one hundred and eighty centuries, prepared the earth for ordinary life. Under the suggestive and appropriate names of the Celestial, Terrestrial, and Human, their deeds are sung in Chinese legends. In these tales we are told how they evolved the relations of the sexes, government, and order, and taught men to eat, drink, and sleep. They enticed fire from heaven, and with it cooked the raw food of the soil for the better support of their protégés who were populating the valleys and plains and mountains they had created. There are no more interesting myths in the poetry and song of the ancient Greeks and Romans than can be found in the fanciful narratives of the Chinese romancers; and, if we investigate carefully the relations of China in the remote past to western Asia, we may be even convinced that the legendary lore of the former antedates the latter in its inspiration and first rehearsal to charmed and credulous ears.

EIGHT GREAT EMPERORS

Fuh-hi, the first landmark of history, and his seven successors held sway for nearly eight hundred years, an average of a century each. The atmosphere of myth still remains here, unless in the repeated songs of their achievements some lesser lights of their dynasty are forgotten. From the number stands out Hwangti, "the founder of China," as he is often portrayed, although the same

honor is given to many others and claimed by more. Hwangti's capital was in Honan, and he is described as extending the empire from Pechili to the Yangtze, while his son even extended the boundaries into Manchuria on the north and Tonkin on the south.

He is given the credit of originating the famous "Cycle of Cathay," the arbitrary period of sixty years, in honor of the sixty-first year of his reign; and he established a regular calendar. But a greater deed was the regulation of weights and measures according to the decimal system. He carried the same principle into the government of his kingdom, making ten towns one district, ten districts one department, ten departments one province, and ten provinces one empire. He built highways upon land, and boats to navigate the rivers, and generally was a wise and progressive monarch.

He was following in the footsteps of Fuh-hi, who instituted the laws of marriage and methods of agriculture and fishing.

The lyre and lute were invented by him to make his people cheerful and content. Chinese characters were devised and family names were then first known.

While all these stories of providing the necessities and of adapting the realities of life suggest a degree of truth, there is woven in with them a large measure of romance that colors their historical value. Fuh-hi attributed all his successes and glorious achievements to the dragon-horse that came out of the Yellow River bearing a scroll on its back, and possibly in this fable we have the crystallization in legendary history of the dragon conception, which plays so important a part in contemporary Chinese romance and reality — which adorns their flags and clothing, is the central figure of their art, and is remembered in their prayers.

But the glory of Fuh-hi and Hwangti is overshadowed by the renown of that galaxy of Chinese heroes, the Emperors Yao, Shun, and Yu, whom Confucius and Mencius, China's two greatest sages, have made immortal. Yao and Shun reigned approximately B. C. 2350–2200, and their names and deeds are known to every Chinese boy and girl. The child of mandarin or coolie will glibly describe their greatness, as the son of millionaire or pauper in America will tell you about Washington or Lincoln.

It is well to note in this connection that the characters which are admired and remembered in China today as in the past are generally men of highest attainments and lofty motives. The sterner records of history tell of evil as well as good men, but the popular narratives, songs, and poems, together with the deep philosophic works of China's wise men, give little consideration to other than the great and good. Thus has there been a continuous and notable influence for the development and betterment of the Chinese peoples from the earliest times, which has had a marked effect upon the life of the empire through its ups and downs of the past centuries. It elevates the Chinese far above and beyond any position as barbarians. It demonstrates the existence of a powerful civilization more years before the birth of Jesus of Nazareth than have elapsed since that chief event in all history startled and amazed the pagan world.

After Yao and Shun came the mighty Yu, during whose reign were two events that will never allow it to sink into entire oblivion. The first was the terrible inundation of the greater part of the then inhabited empire by China's sorrow, the Yellow River. The second was the discovery of the manufacture of wine. Which has been the worst for mankind might be difficult to determine! Yu, after he had enjoyed his first experience with the beverage, sagely remarked, "The days will come when

some of my successors, through drinking this, will cause infinite sorrow to the nation." Yu was the founder of the Hia or Hai dynasty, which controlled China from 2200 to 1818 B. C.

The records of Chinese historians are not definite in naming the year when the Chinese settlers first arrived in their new home, but it was in these early semi-legendary years. By some the time is placed before the days of Fuh-hi or as contemporaneous with his reign. Others contend that they came about 2500 B. C., antedating the reign of Yu; but nearly all agree that the Chinese were not natives. They came, if we are to take the word of Confucius, from the valley of the Euphrates or from the regions of the Caspian Sea. Journeying for a new land and home, they persisted in their eastern pilgrimage by a northern route and entered China through the valley of the Hoangho or Yellow River, until finally they were stopped by the boundless waters of the Pacific.

The fact that the Chinese were not indigenous adds vastly to interest in the study of the growth of the empire. It establishes a degree of sympathy on our part with their history that we might not otherwise feel. The present dominant American race were not aborigines; we drove the latter unmercifully before us and ruthlessly took possession of this continent. So the Chinese, entering their new field of effort, gradually drove before them the natives until now there are left only small numbers of the aborigines, who have their home and rendezvous in the fastnesses of the southern mountains. The Chinese seem to have begun their empire with isolated bands of colonists in the northern, central, and western provinces of Shensi, Shansi, Honan, and Hupeh, just as the first Europeans established themselves in Massachusetts, Virginia, and Florida. Now they reach over an area larger than that which is under the sovereignty of the American people.

The mighty Hia dynasty was doomed to end through the very means that Yu predicted. It went out in debauchery and unbridled voluptuousness, under the lead of vain Kieh-Kwei, and of his beautiful but wanton consort, Meihi.

The dynasty of Shang then assumed power, and 28 sovereigns occupied the throne through 644 years. These kings were good and bad, strong and weak, and the empire prospered and suffered, extended and contracted, according to the character and power of these men. If we will pause and think what a period of 644 years and 28 monarchs means, and yet what little impression they made on history beyond a passing record of the usual wars, cabals, and strifes, we are in a mood to appreciate how trifling a portion of history's long story the present exciting times may occupy in the minds of the future historians.

RECUPERATIVE CHARACTER OF CHINESE

Let us remember, however, one consideration that augurs well for China in the future, as it has figured conspicuously to her advantage and in her growth during both the clear and the misty centuries of time that is gone: the end of the majority of the dynasties has come under the reign of evil or weak minded men and women, when it deserved to end and when it was best for the people and kingdom that a change should be inaugurated, and with few exceptions the succeeding monarchs have been men of eminent ability and leadership. This recuperative feature of China—of her dynasties, kings, and people—which has been illustrated repeatedly through fifty centuries or seventy-five cycles, may prove her salvation in the present crisis. No other nation in the history of the world has successfully mastered the events of centuries like China. If the principle of the survival of the fittest is demonstrated as logical and true in the

unlimited past competition of peoples and governments, and has kept China in the front as an independent power, will not its application in the future be attested by a newer and greater China rising out of the trials and confusion of the hour? With such an evolution of events, the policy of our Government of friendly assistance to China would seem all the more wise, and fraught with favorable results alike to Cathay and America.

THE GOLDEN AGE IN CHINA'S ANCIENT HISTORY

Out of the darkness shall come light. From the haze of the Shang dynasty was born the incomparable Chow dynasty, which boasted of thirty-five rulers and lasted through nine eventful centuries, from B. C. 1122 to 255. This period was a golden age in China's ancient history. It was the bridge between the doubtful past and the actual present. But its crowning glory was the appearance of Confucius and Mencius upon the stage of the world's history; nor should Laotze, the founder of Taoism, be omitted. He figured in the same dynasty, but his work was not so much for the bettering of his fellow-men as were the teachings and example of Confucius.

When we discuss at the dinner table, in lecture-rooms, and in social and literary intercourse the golden ages of Greece and Rome we are prone to forget entirely that in China there was a corresponding age, when real civilization in its broad sense reached a mark as high even as it did in southern Europe. It began in strength, blazed into unparalleled brilliancy, and then sank into decadence, to be followed by a period when the dregs of misfortune were drunk by the people; and such was the record also of European and western Asiatic powers.

If the founder of the Chow dynasty, Wu Wang, were alive today he would be the man of power, ability, and leadership to save China. He found the empire in a more deplorable state than Kwangsu, the present ruler, when he ascended the throne. He made it respected throughout Asia. Embassies came with tribute from Korea on the north, Cambodia and Siam on the south, and Tatary and Tibet on the north and west. But in his power he made one cardinal error: he established the system of feudal states and feudal lords. Their struggles and wars were the influences which eventually wrought the downfall of his dynasty.

Singular enough, great national progress was made during these times of strife, and the boundaries of the empire were enlarged in proportion to the internal wars. The foundation was laid for the greater China that was to follow.

If nothing stood to the credit of the Chow dynasty other than the life of Confucius, it would have honor enough, without even including Mencius and Laotze.

CONFUCIUS AND HIS PRECEPTS

Confucius was born 551 years, or nearly six centuries, before Christ. Beyond a few myths and legends connected with his birth, there is nothing fabulous about his life. He stands out clearly as one of the greatest men that the world has ever produced. He was a man, not a saint; a man who went through the average experiences of a scholar and statesman in public life, and who in an unpretentious but sincere way endeavored to better his fellow-men. He gradually rose from low estate to be a magistrate, and finally became the prime minister of Duke Ting. He was an eminent lawyer, not unlike Moses or Solon, and was a practical philosopher like Benjamin Franklin. He was a man of the people and knew their impulses, hopes, and wishes like Abraham

Lincoln. It was because he understood man's nature that he was able to make such a lasting impression. The masses of China study his precepts today as they did twenty centuries ago and will twenty centuries hence.

Confucianism has its failings and weak points when regarded as a religion and must in the evolution of time give way as a religion to Christianity; but as the teachings of a great philosopher his works will never be forgotten. In fact they will have in some respects a wider hearing and following when the European and American world studies more the interesting and instructive history of Cathay.

Confucianism became a religion not through any intent or purpose of its founder. He never endeavored to start a religion, to be considered as a god, or as a prophet of a god. The doctrines, precepts, and philosophy of Confucius became a religion because they were purer and higher than the conceptions of any other religion that in those days was offered to the people; they were beyond and above the teachings of Laotze or Buddha in the mind of the average Chinese ruler or vassal. By natural evolution in the imagination of the people he became in a measure a god, but it is well to be remembered that he did not believe in any existing God, and there is no hint in his philosophy of a future life. When asked what was his opinion of death he replied: "How can one know death when one does not know life"?

To those who have firm belief in a living God and in the immortality of the soul, it would not seem that Confucianism could stand as a religion against the expanding influence of Christianity. No matter how much we admire the character and teachings of Confucius, there are lacking in his philosophy the two great essentials of faith and hope which are so dear to the Christian world. Charity there is in Confucius' teachings, and that is a principal element in making them strong.

Love, respect, and worship of ancestors, which have played so important a part in China's political, material, and moral development, are fostered by the precepts of Confucius. His portrayal of the lives of the mighty Yao and Shun of the mythical days, and later of Wan Wang, Wu Wang, and Chau King, of the Chow dynasty, tended to develop a deep sense of ancestral homage. In the growth of China this influence has, on the one hand, protected the family and the state, and, on the other hand, retarded material progress. Worship of ancestors, with its virtues and faults, has been a synonym for conservatism in China. What was sufficient and satisfactory to their ancestors should be sufficient and satisfactory for the present generation! The fear, for instance, of disturbing the rest and peace of ancestors and of doing unpardonable slight to their memory has in a measure prevented the opening of the earth for its mineral and metals, has retarded invention, and in these later days checked such far-reaching enterprises as railway construction and further modern development of China's material resources.

If Confucianism is a religion, it is *the* religion of China; but Buddhism is also in a sense *the* religion of China, with Taoism, founded by Laotze, in a pronounced secondary position. Every Buddhist and every Taoist, however, is a disciple of Confucius to a certain degree, while a great number of the followers of Confucius are not Buddhists or Taoists. Every Chinese child is a student of Confucius. All of my Chinese servants could recite his principal precepts. They seemed to understand them also; but oftentimes they were in doubt about their real respect for Buddha and Laotze.

It is not within the scope or purpose of this paper to compare the teachings of Christ and Confucius; but in dis-

missing reference to such comparison it is interesting to remember the words of one distinguished savant, Dr. Legge. He says: "The teaching of Confucianism on human duty is wonderful and admirable. In the last three of the four things which Confucius delighted to teach—letters, ethics, devotion of soul, and truthfulness—his utterances are in harmony with both the law and the gospel."

Possibly the remarkable honesty of the Chinese as business men and merchants in dealing with foreigners, which has been a marked national trait in their commercial relations during the last sixty years, should be attributed to Confucius. Possibly it is due to native shrewdness; but it is so surprising to the average foreigner that it is worth recording here.

Mr. Thomas Whitehead, the distinguished manager of the great chartered bank of India, Australia, and China, which is the second largest banking house in Asia, says that his institution has never directly lost a penny through Chinese dishonesty in transactions representing many millions of sterling. The famous Asiatic foreign house or hong of Jardine, Matheson & Co. declare that they have lost more money to 8 per cent of foreigners than to 92 per cent of Chinese, in a total trade of 100 per cent, covering a period of nearly sixty years and representing one hundred millions sterling!

Mencius was a scholar, thinker, and philosopher second only to Confucius. His time is placed about 300 B. C. His teachings, moral deductions and precepts, epigrams, and wise sayings are studied and committed today by every native in China, and, next to Confucius, he has exerted a mighty influence on Chinese development.

Of the personal Laotze we know but little. He was a man of profound learning, but there has been handed down no such historical record or collection of his writings as we have of his colleagues, Confucius and Mencius. His religion, Taoism, has at all times exerted a profound influence on China's history, but has never stood with the continuous strength of Confucianism. Some monarchs were entirely under its sway, while others decreed death to all who followed it. The original Taoism was perverted and changed, it was even assimilated by the Buddhism of China, for this variety is a corrupted branch of the old Indian stock. There was much in the early Taoism that suggested thoughts and ideas akin to Christianity. The immortality of the soul was partially pictured, though in a material, rather than in a spiritual, sense. In later days Taoism became the superstitious theory of magicians and of kings who would seek perpetual life through extraordinary elixirs and decoctions. Today it has many astute and devoted followers, but it is decadent as a religion and has passed long ago the day of its influence and power among the great religions of the world.

THE IMPORTATION OF BUDDHISM FROM INDIA

Buddhism in China is a transplanted product. It was brought from India as a sprig of one fruit might be grafted on the tree of another Buddhism was grafted, in a measure, on Confucianism. It would never have thrived in China if Confucianism had been an actual religion like Christianity or if Confucius had been an inspired being like Christ.

Sixty years after the crucifixion of Jesus Christ the Emperor Ming-ti, of the Han dynasty, dreaming of a gigantic image of gold, dispatched an embassy to India to find a new religion. They returned with Buddhism. The doctrine of the transmigration of souls delighted the mighty Ming-ti. The rewards and punishments it outlined seemed reasonable, and the possibilities it pictured of

a future life supplied to him and his people what was lacking in Confucianism. Ming-ti was a practical, business-like monarch and went about the propagation of Buddhism as he did the promulgation of new laws and the collection of additional taxes. In that way it was given an impetus that enabled it to spread throughout all China. It undoubtedly tended to raise the moral standard of the people and nation, and hence was a direct influence on the growth of the kingdom. The Buddhism of today in China bears little resemblance to the purer Buddhism of Ceylon or Siam.

The King of Siam, who is the *ex officio* head of the Buddhist church of the world and one of the ablest and most progressive statesmen in Asia, often told me while I was the American Minister at his court, that the Buddhism of China was such only in name and was inextricably mixed with Taoism and Confucianism. The Chinese emigrant to Siam is at home in its Buddhist temples, but the Siamese who goes to China is not at home in Chinese temples.

There is a passing thought in this connection that almost staggers us. Supposing Emperor Ming-ti's embassy in search of a religion had journeyed to Palestine instead of to India and brought back Christianity? It taxes the imagination to picture the effect on China, on Asia, and on the world at large, if it had come in its purity. On the other hand, we are forced to ask with equal astonishment at the possibilities: What would have been the effect on Christianity if it had been taken in those early days by the Chinese as their official religion?

THE COMING AND EXPULSION OF CHRISTIANITY

But Chistianity did come to China long before the day of modern missionaries. Christianity was taught and fostered for one hundred and fifty years during the middle ages of China, between 600 and 800 A. D. The Nestorians, who taught the new religion to China, thrived for nearly two centuries, or until 781 A. D. About 1625 A. D. the famous Nestorian monument was unearthed in the province of Shensi. Williams, in his "Middle Kingdom," holds that the Nestorians came as early as 500 A. D. He says that the monument is "the only record yet found in China itself of the labors of the Nestorians," and yet it is one of the most perfect of the ancient monuments of China. The inscription tells us that a priest named Olopun came from the distant west, guided by the "azure clouds" of China, bringing with him the "True Scriptures." The emperor, one of the most powerful of the Tang dynasty, gave him a cordial reception and ordered the Scriptures translated and promulgated. In an official edict he said: "Let it have free course through the empire."

Unfortunately for its lasting influence it came under the ban which the Taoists, about A. D. 850, proclaimed against Buddhism through the agency of an hostile emperor. The effort to crush the Buddhists included the Nestorians, and only the monument remains. If sufficient time had passed for Christianity to have spread itself as had Buddhism, this one attack would not have ended its life in Cathay until again revived by American and European missionaries. It is an interesting coincident that the Nestorians were apparently most severely persecuted in the same section of China where many American and European missionaries were recently massacred.

Before leaving the subject of religions I would add, in response to the general inquiry about missionary work, that I honestly believe, after six years' experience in Asia in both official and private capacities, and after spending much time in China, not only along the coast, but

in the distant interior, that the missionaries are doing far more good than harm, and that they should have the moral support of the American people in the continuance of their labors.

There are incompetent missionaries as there are incompetent business men. They have faults. These should and will be corrected and the work will go on. Missionaries will be a help and not a hindrance in the regeneration of China. The commercial spirit leading to ruthless territorial aggrandizement, manifested by the European powers, must bear the responsibility for the Boxer outbreak as much as the zeal of missionary evangelization.

Such men as Li Hung Chang, Sheng Liu Kin Yi, and Chang Chi Tung have told me unofficially that they had no objection to Christian missionary work where it was carried on by worthy men, but complained that too often indiscreet and incompetent men were in charge who excited hostilities and caused trouble for the majority of the missionaries who were qualified and successful.

This discussion of religions, into which I have gone to some length, although cursorily, began with a consideration of the character of the teachings of Confucius, who lived in the illustrious Chow Dynasty period. From the date of its ending, in 255 B. C., we pass on rapidly down through the long historical corridor of succeeding and changing Chinese dynasties. Some we admire; some we abhor. Some we praise; some we decry, but it is the same old story of ups and downs, great and little men, good and bad men, until we grow almost weary of the tale, and are constantly reminded that in the dim future these present days of critical negotiations at Pekin may seem of little importance. Let us hope that their conclusion and results may warrant a higher measure of praise than we can bestow on many of the crises of the limitless but *fascinating* past.

THE GREAT WALL

During the Tsin dynasty, which succeeded the Chows, the major portion of the great wall of China was constructed. This was approximately 240 B. C., but some 250 or 300 miles of the wall were added nearly 18 centuries later, in 1547 A. D., by an emperor of the celebrated Ming dynasty. Let us remember what this means. A wall begun at one time two centuries before Christ was completed nearly sixteen centuries after Christ. Can anything better illustrate the great age and astonishing conservatism of China than this simple record? What are the sixty years of China's present modern foreign relations—one cycle of Cathay—in comparison with these eighteen centuries which history tosses up and off for our study as if only eighteen days!

The builder of the wall was, however, a great man. Some call him the Napoleon of Asia. Chung was his name, or Hwang-ti, as he called himself. He built magnificent palaces, constructed roads, dug canals, and did all in his power to make his kingdom mighty and prosperous, but was guilty of one unpardonable offense. Wishing to go down to posterity as the *first* king of China, he ordered the destruction of all the old records and libraries, and decapitated hundreds of scholars. For this he was never forgiven by the Chinese people, and few praises are now sung in his honor. Fortunately for China sufficient records were preserved, and literary men survived to replace later the destroyed records, legends, and histories. He was succeeded by the Han dynasty, which held sway from 206 B. C. to 225 A. D.

RELATIONS WITH THE ROMANS

The Han dynasty, that started before the Christian era and reigned into it over two centuries, saw the first commercial relations established with the Roman

Empire. The latter even sent an embassy to China, and presents were exchanged. Ptolemy and Pliny wrote of the Seres, a name which described the Chinese; and China was distinguished at times far apart by Sin, Chin, and Sinae. "The reign of the Seres was a vast, populous country, touching on the east the ocean and the limits of the habitable world, and extending west nearly to Imaus and the confines of Bactria," says Yule, adding, "It seems probable that relations existed from the earliest times between China and India, and possibly, too, between China and Chaldea. The 'Sinim' of the prophet Isaiah is by many taken to mean China, and the Ptolemys 'Sinae' are generally understood to have been the Chinese."

In the forty-ninth chapter, twelfth verse, the great prophet says, "Behold, they shall come from far: and, lo, these from the north and from the west; and these from the land of Sinim."

I referred to the honesty of the Chinese; that same story was told in Europe twenty centuries ago. Therefore the reputation of the Chinese for integrity, in spite of all that is said against them, has some good foundation. Justinian was the next great western writer who discussed the Chinese; and then Marco Polo, returning from the magnificent court and mighty empire of the imperial conqueror Kublai Khan in the thirteenth century, awoke the world to its first actual appreciation of the extent and power of Cathay.

The Roman Empire was often described by early Chinese historians as a nation with which China enjoyed trade exchange. The land of Tatsin-Kwoh was the name of this European kingdom in Chinese terminology.

While Rome was in the height of her glory and preparing the way for her downfall the Han dynasty was sailing on the flood tide of prosperity, great wars, territorial aggrandizement, and splendid material progress. When we consider that such an eventful period is included in the records of Chinese history, we wonder that we have not given it more attention in our study of former civilizations. In those days we are told that temples and palaces were erected larger and grander than those of contemporaneous Rome and Greece; canals were dug of sufficient depth to float ponderous junks; walls were built that reached over high mountain tops; roads were opened that connected capitals and trade centers; wars were waged that killed millions of men, and peace and strife alternated from decade to decade. There was bloody civil contention among the feudal chieftains at one time, and then again a war of the entire united empire against a foreign enemy. The present Boxer uprising would have been treated in those martial days as an amusing incident, and no foreigner would have been spared to tell the tale and write lurid accounts for the magazines.

The contemplation of China's wonderful past suggests at once the question, Why, if such great deeds were done and such splendid buildings, palaces, and roads were constructed, are there not more tangible evidences remaining of these and later glorious periods? The answer is simple and conclusive. First, every new emperor, or the founder of each new dynasty, who was not friendly to his predecessor seemed prompted by an immediate and overwhelming desire to destroy all the signs of his predecessor's work and power, and proceeded to raze not only to the ground but obliterate all monuments of former glory. Secondly, there are remaining, even against such adverse conditions, more monuments of the past than are generally remembered in a discussion of this subject, such as the great wall, the Ming tombs, the Temple of Heaven, the Grand Canal, paved roads, great arched bridges, porcelain pagodas, and numerous lesser signs, like the Nestorian Monument.

Students of China will await, moreover, the new life in the empire and the opening of the interior in the hope that excavations in interior cities and the bringing to light of old records may tell us more than we now know and better explain and illustrate the conditions of the dazzling past.

China's famous competitive examinations were begun under the Hans; a penal code, the model of all subsequent ones, was drawn up, and, as before recorded, Buddhism was first introduced from India. The limits of the empire were extended until under the Western and Eastern Han dynasties they included Szechuan, Yunnan, and Fukien.

Romance tells its story of these times in the great Chinese historical novel entitled "The History of the Three States," which immortalizes in a halo of glory that period, which was at its height about three centuries after the birth of Christ. Every Chinese delights in this graphic story of valorous deeds.

We now pause at the threshold of the illustrious Tang dynasty, that shaped Chinese destinies for three hundred years, A. D. 618–907. To reach this period we pass the Tsin and Eastern Tsin dynasties, that succeeded the Hans and ruled for one hundred and fifty years with another group of fifteen monarchs. A few lesser dynasties followed, and then the first Tang began his beneficent sway. During this dynasty Korea became an acknowledged dependency of China, Siam sent tribute-bearers, and Persia sought aid from the Chinese Emperor in a war with other lands. It was one of the Tangs that welcomed the Nestorians. The canal system of China was extended, libraries were built, schools opened, and the people were occupied peacefully and happily with agricultural pursuits for unusually long periods. The Hanlin Library and College was founded in 755, the writings of Confucius were newly annotated and revised, and poets, essayists, and historians thronged the courts of the emperors in place of eunuchs and concubines. But if preceding dynasties had been disgraced with beautiful and dissolute but powerful women, who controlled the empire by controlling their emperors and ministers, the Tangs had likewise the cruel and immoral but brilliant and able Empress Wu. She ruled China with a rod of iron and to the benefit of the people for fifty-four years.

Arab travelers who visited China in those days returned with stories of copper money, rice wine, and the use of tea as a beverage. Envoys of the Pope at this period sought to know more of China, and Mohammedanism also then first gained extensive entrance into China and became a factor in its development.

Looking to Europe, we find that England was then divided among the Saxon princes, and France and Germany were in that chaotic state which preceded the reign of Charlemagne. The discovery of printing is ascribed to this period, or about A. D. 581, nine centuries before Caxton introduced printing into England. In the siege of Tai-yuen, in the eighth century, gunpowder was used in cannon that threw 12-pound stone shot some 300 paces. After twenty emperors had reigned and China began to see the approach of a modern period of history, the Tang dynasty ended with a desolate land, ruined towns, and the capital razed to the ground by fire and vandal conquerors.

(*To be concluded in the July number*)

THE DIKES OF HOLLAND

By Gerard H. Matthes, United States Geological Survey

To obtain an idea of the important role the dikes have played in the development of the Netherlands, and of the problems with which the inhabitants of that country have had to contend, it is necessary in the first place to understand how the soil of the Netherlands was formed, and what the peculiar conditions are that have rendered the existence of this unique little country possible. A few words concerning the geology of the region, which dates back to a time by no means remote, will therefore be of interest.

Geologically speaking, a large portion of the Netherlands may be said to have been formed only yesterday. This portion, which comprises the western and most interesting half of the kingdom, owes its origin to the alluvial deposits brought there by three large rivers—the Rhine, the Meuse, and the Schelde—the estuaries of which unite to form what at first glance appears to be a delta. The large amount of sediment discharged by these rivers, together with the action of tides and currents in the North Sea, were the primary causes of the formation of extensive series of sandbanks and bars off the coast, and as these banks grew higher and finally became exposed to the action of the wind at times of low water, there came into existence sandhills, commonly known as dunes. The coast in those days partook much of the nature of a "haff," such as is found today on the German coast on the Baltic Sea, or along our own coast, notably at Pamlico and Albemarle Sounds. A long tongue of land running parallel with the coast inclosed a body of shallow water into which discharged the three rivers. It is natural to suppose that after the formation of this haff, sedimentation progressed rapidly. Heavy deposits of clay gathered in its quiet waters, and later, as the haff grew more shallow and aquatic vegetation be-

came luxurious, extensive marshes came into existence, and the great peat beds which cover so large a part of the area of Holland at the present day were formed.

Interesting as are the successive steps in the formation of the country during those early days, space will not permit here to treat of them at length. Suffice it to be said that after the general level of the deposits had reached that of the sea, there arose vast forests, which at one time covered almost the entire country

of the Netherlands. The rivers found their way to the ocean through numerous tortuous channels, but there remained in the center of the country a small lake, called by the Romans at a later period "Lake Flevo." Thus the soil of the Netherlands, having been formed in part by alluvial deposits and in part by the formation of peat beds, cannot be called a delta formation, in the strict sense of that physiographic term, however much its appearance in a general way may resemble that of a delta.

The earliest records make mention of this region as a low, marshy, and heavily timbered area, protected against the tides of the North Sea by ridges of sandhills, and subject to flooding by both fresh and salt waters.

THE FIRST DIKE-BUILDERS IN HOLLAND

The first inhabitants of this inhospitable region were nomadic tribes of Germanic origin, known as the Catts and the Caninefates, and they must be regarded as the pioneers of dike-building. Though dwelling at first on the higher eastern lands of older formation, it is known that they finally settled in the lowlands, where, exposed to the constant danger of inundations, they soon learned to protect their lives and property by the building of levees.

Perhaps Holland in those days was not as undesirable a piece of land as it might prove in these days. At any rate, as early as 400 years before the commencement of this era, the Romans had begun its conquest, and were undertaking a number of improvements, the magnitude of which leave no doubt as to the value they put on their new acquisition. About 10 B. C. the Roman general Claudius Drusus, in order to relieve the Rhine of a part of its burden, connected it with the Ijsel by means of an artificial canal, which may safely be said to have been the first canal dug by the hand of man in Holland. According to Tacitus, the Roman general Germanicus, a son of Drusus, is said to have transported his army down the canal on floats constructed with the timber cut from the forests. Again, history tells us that the same general Drusus caused a levee to be built along the middle arm of the Rhine, in order to protect the province then called Bat-Aue ("good land") against the inundations caused in spring

The Netherlands of Today and the State of Ohio compared

by ice jams on the rivers. This same levee was completed some years later by general Paulinius Pompeus, and extended to the mouth of the Rhine at Katwijk, where there existed a gap in the dunes through which the Rhine discharged into the sea.

At some distance from its mouth, on the inland side of the dunes, the Romans constructed a large castle, known as Castle te Britten, and on an island in the estuary they erected a light-house, which bore the name of General Caligula. The castle is of interest because from the present location of its ruins important

conclusions may be drawn as to the shifting of the dunes. After having been sacked and burned by the Batavians, rebuilt again and destroyed once more by the Normans at a later date, the ruins of the castle were during the eighth and ninth centuries gradually covered by the shifting sands of the dunes, which were slowly being transplanted landward by the winds. The ruins disappeared and had been forgotten, when suddenly, after the severe storm of Christmas, 1520, they reappeared once more, but on the beach west of the dunes. Since that time they have in the course of centuries repeatedly been denuded and covered up again, and at the present day lie submerged in the sea.

RECESSION OF THE COAST LINE

It has been estimated from these facts that the dunes near Katwijk have migrated east a distance of two miles in about eighteen centuries. At other points along the western coast of Holland this receding movement has amounted to as much as six and seven miles during the same period.

It was not easy to put a stop to this alarming recession of the coast and consequent loss of land, together with the destruction of numerous flourishing villages. It has been permanently effected, however, by planting on the seaward side of the dunes a species of grass (*Arundo arenacea*), known in Holland as "Helm." This plant can sustain itself very readily in the finest and purest of sands by means of extraordinarily long and intricate roots, and is therefore well qualified to counteract the shifting of sand. The grass is planted by hand in tufts not quite two feet apart, aligned in rows. That this was a laborious piece of work needs no demonstration, when it is borne in mind that there extend along the coast of Holland a chain of dunes of a total length of 200 miles, varying in width from 400 yards to three miles, while the elevations range from 60 to 200 feet above sea-level. In other places forest growth has been started on the dunes lying further inland, and the results have been very gratifying.

1,500 SQUARE MILES OF LAND SUBMERGED IN THE INTERIOR AND THE FORMATION OF ZUIDER ZEE

The retrogression of the dunes was a source of alarm; yet, on account of its slowness, the movement had not at first made itself manifest. Very serious changes had taken place, however, in the interior within a comparatively short period. Furious storms in the North Sea during the years 693, 782, 839, and again in 1170, 1230, and 1237 had caused a washing away of large sections of peat land situated between Lake Flevo and the North Sea. This wholesale destruction of land culminated in 1250, 1287, and 1295, when during the spring tides of those years Lake Flevo had become an inlet of the North Sea. It is estimated that this loss amounted to nearly 1,500 square miles of land, and submerged a number of flourishing villages. Heavy dikes were then built, inclosing the so-formed Zuider Zee, except at such points where it communicated with other bodies of water, in order to check all further encroachments on the land. Its form has since been practically the same as now appears on our maps.

With the advent of the fourteenth century began a period of active dike-building in Holland. Not only the Zuider Zee had swallowed much rich, arable land, but many of the interior bodies of water, at times of storms, were making similar trouble, and inundations caused by the large rivers were frequent. Obviously, as the country became more closely settled and land became more valuable, every new inundation caused more loss of life and property than had

previous inundations. These catastrophes, attended with the loss of thousands and thousands of lives, fill many a sad page in the history of the country. Dike-building became a serious matter and began to receive the attention which it had long needed. Flimsy dikes and levees were gradually transformed into heavier structures, and the physical outlines of the Netherlands were thus rendered more permanent and may be said to have suffered little change since that time.

The province of North Holland about the year 1288, although extensively protected by numerous dikes, was dissected by bodies of water of all sizes, such as the Schermer, the Beemster, the Purmer, the Starnmeer, the lakes west of Alkmaar, and the Langemeer, connecting with each other, and also with the Zuider Zee at several points. It was possible in those days to navigate from Amsterdam westward through the Ij, then through the lakes mentioned, and return by way of the Zuider Zee, without finding an obstacle in the form of a dike, or as much as a lock. With the expansion of Lake Flevo into a wide-mouthed inlet of the North Sea, the action of the dreaded tides and storms of the latter were carried into the very heart of the country, thereby raising considerably the levels in the lakes before mentioned and threatening new inundations. To remedy this dangerous situation, the three channels connecting the lakes with the Zuider Zee were closed by means of heavy dams during the years 1311–1400. In the main, however, the aspect of the country changed little between 1288 and 1575. Before the beginning of the seventeenth century there probably was felt little need of securing additional arable land; possibly pecuniary difficulties forbade the expenditure of the large sums required for draining the lakes, and more likely difficulties of a technical nature stood in the way. At any rate, the lakes drained during the fifteenth and sixteenth centuries were few in number. About the middle of the fifteenth century windmills for raising water were coming into use in Holland. These were at first of a primitive character and of low power, but they were applied to the pumping out of lakes in process of reclamation.

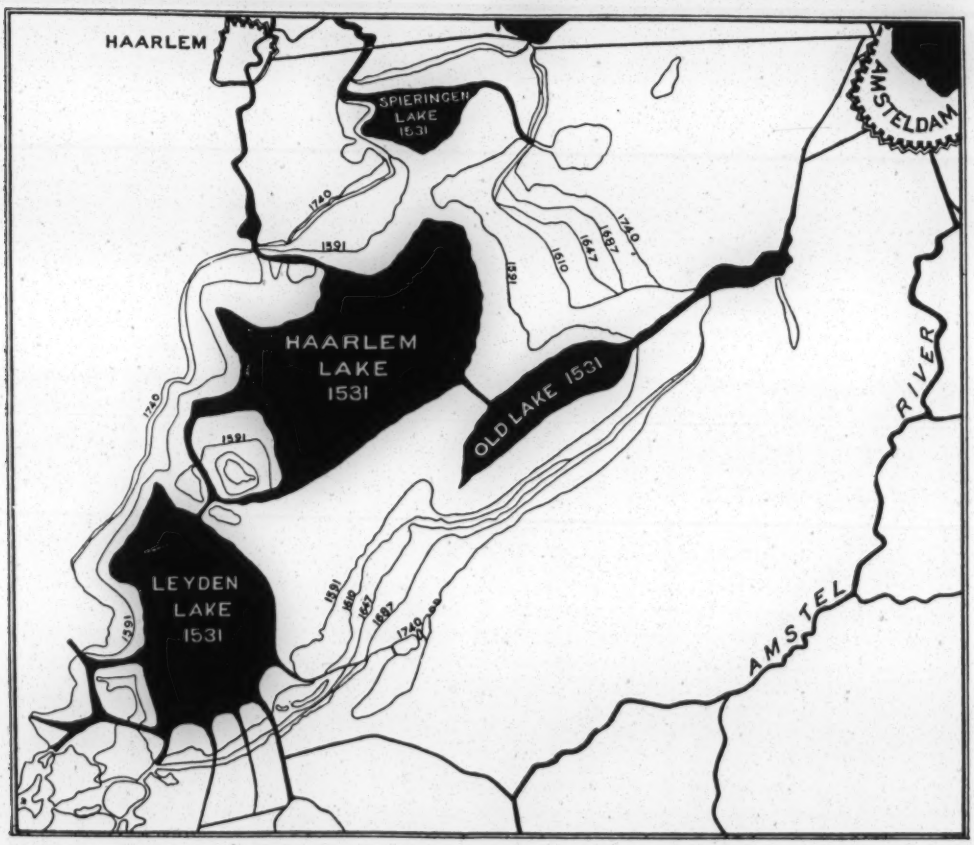
RECLAIMING THE LAND

The great period for reclaiming land, however, did not begin until the early part of the seventeenth century, at a time when prosperity returned in Holland and great enterprises of divers character were begun. With the revived interest in agriculture and cattle-raising, the rich soils covered by the lakes became valuable, and every effort was made to drain them or to keep them within the smallest limits. This became urgent for the further reason that new lakes were constantly being created by the digging away of the peat for fuel. Between the years 1607 and 1643 sixteen lakes were permanently drained, adding to the territory of the Netherlands, within the space of 36 years, an area of 91 square miles, or nearly 60,000 acres.

All these lakes were drained with the aid of windmills. A lake was first inclosed by a dike to cut it off from surrounding bodies of water. This work was always of a difficult nature, consuming much time and money, as it frequently happened that during some storm the dike gave way. The inclosing dike once completed, the windmills, constructed in the meantime, commenced draining off the water into adjacent waterways. These latter were properly connected with each other to keep up the navigation in that section of the country and to carry off the water pumped out of the lake. Such a system of communicating waterways and canals is collectively known as a "bosom," and they in their turn dis-

charge the surplus water into the sea at times of low tide, while at times of high tide they are closed by means of locks. Even after the lake had been drained the same system was preserved, only less windmills being required to keep the lake bottom dry. In general, any section of land artificially drained, and known in the Dutch language as a "polder," has a "bosom" surrounding it, into which is delivered by the windmills all the water that collects in the polder. The polder, for this reason, is intersected by a network of ditches, carefully spaced and graded in such a manner as to drain the surplus moisture from the soil and conduct it to the windmills. The amount of ditching required to accomplish this as a rule covers an area equivalent to one-twelfth of the total area to be drained. Thus the Hollanders not only keep their polders dry, but provide at the same time ample means for navigation, the main canals and ditches being from 25 to 40 feet in width.

Before the invention of the steam-engine, windmills were exclusively employed in the work of draining the polders, but as the power of a windmill is rather limited, the lift was as a rule inconsiderable. In later years, when deeper lakes were drained, either steam-engines or series of windmills placed at successive levels had to be resorted to. Thus at the time of the reclamation of



Successive Enlargements of Haarlem Lake

the Beemster 49 mills were constructed, disposed as follows: 11 series of 4 mills each, 1 series of 3 mills, and 1 series of 2 mills. The work was commenced in 1608, when the dike was constructed, and the draining begun in 1612. The cost of this work amounted to $760,000, the total surface thus reclaimed being 17,720 acres.

THE DRAINING OF HAARLEM LAKE

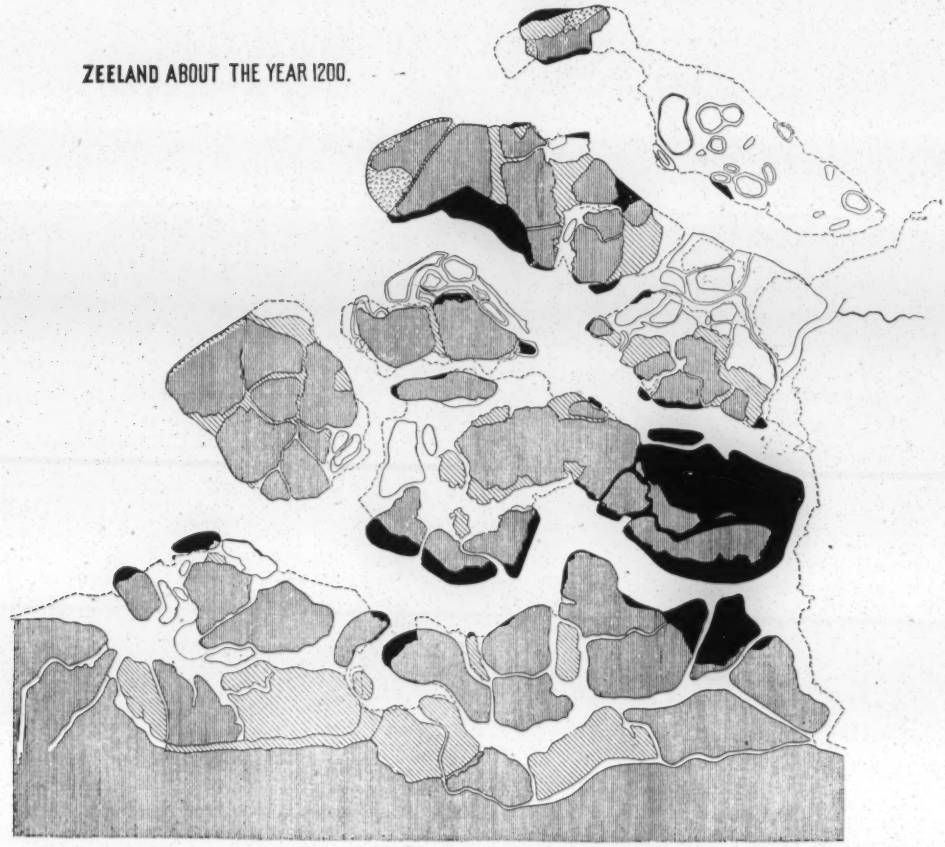
Since the invention of the steam-engine works of a greater magnitude were entered upon. Prominent among the latter is the draining of the Haarlem Lake. Originally there existed in this locality four small lakes, as the old maps of 1531 show us. In consequence of successive storms, which caused the destruction of the adjacent peat lands, the four lakes merged into one, and the new lake thus formed became a source of much anxiety. With the increased surface exposed to the action of the winds, the waves on the lake became more powerful, and large sections of peat land were bodily swept away. The four lakes in 1531 covered an area of 22 square miles, but their surface nearly doubled in 1591, when they merged together. In 1647 they covered 56 square miles; in 1687, 60 square miles, and in 1848, 65 square miles, or three times their original area. When during a storm in the fall of 1836 the city of Leiden was flooded by the waters of the lake, the situation became untenable and the government decided to drain the lake.

Between the years 1840 and 1846 the lake was inclosed by a dike 37 miles in length. Three powerful engines were built of from 380 to 400 horse power each, the largest one of which operated eleven pumps each 63 inches in diameter and with a lift exceeding 15 feet. With the aid of these engines the lake, which averaged 14 feet in depth, was pumped dry during the years 1847 to 1852, exposing 42,000 acres of excellent arable land, for with the removal of the peat by the storms the rich alluvial clay underlying the latter had been laid bare. The government has felt itself amply repaid for the enormous sum of $5,568,000 which was expended on this work. The sale of land yielded a revenue of $3,142-800, and indirectly a great many incalculable advantages have been derived from it. (See map on preceding page.)

The last of the great works of this class that have been accomplished is the reclamation of the Ij, at one time an inlet of the Zuider Zee, and the construction of the large canal connecting Amsterdam with the North Sea. This work was completed in 1876 and the canal opened to navigation on November 1 of that year. Twenty-two square miles of excellent land were thus added to the kingdom. Space does not permit here of a description of the technical difficulties that were overcome in the construction of this magnificent canal, through which the largest sea-going vessels now pass daily on their way to and from Amsterdam.

LAND RECLAIMED FROM THE SEA

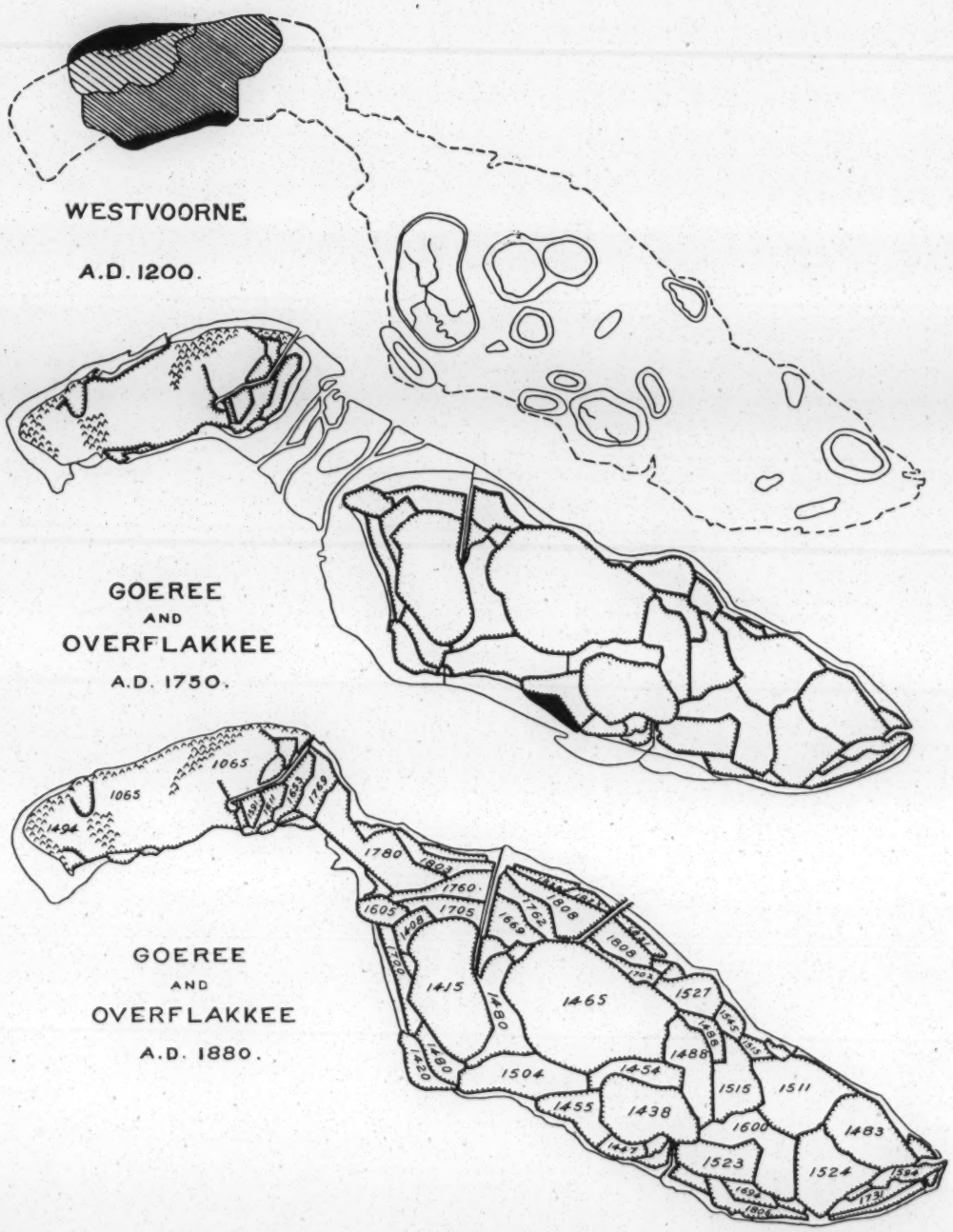
Next to their use in reclaiming land covered by fresh water, the dikes have been of great importance in reclaiming land from the sea. The province of Zeeland, which occupies the southwestern corner of the Netherlands, is composed of a number of islands, conspicuous for their fine agricultural lands and for the thrifty populations which they support. The larger part of this province has been formed by the hand of man out of the numerous shoals, clay-banks, and sandbanks that existed here centuries ago. The archipelago of Zeeland, as well as some of the islands situated to the north of it, lie scattered in the broad estuaries of the principal rivers, and are consequently entirely alluvial formations. The fine silt carried in suspension by the rivers was de-



posited, building up the claybanks little by little, until they became exposed at low water in the shape of mudflats.

As early as the year 1000 enterprising individuals had begun to build small levees along the edges of these flats, in order to prevent the tides from washing over them, and gradually there arose from out of this shallow body of water a number of islands, the nuclei of the present archipelago. As the banks became larger, built up by the river deposits, aided by artificial devices for catching silt, new dikes were built further out into the sea, and the islands grew slowly as piece after piece was added to them. (See diagrams, p. 226.)

The growth of these islands is an admirable illustration of the untiring and steadfast persistency so characteristic of the Dutch people; for the work of reclaiming land from the capricious North Sea was fraught with much danger and tribulation. Again and again during severe storms the sea broke through the dikes and invaded the land acquired with so much painstaking labor, and in several instances areas were irrevocably lost. It must be remembered that this land was obtained by draining the water from an exceedingly humid, clay-like soil. This drying-out process, for such it really was, entailed as a natural result a shrinkage of the solid materials, which



These three Diagrams show the Enlargement of one small Mud Flat to ten times its original size

in many places has been very considerable. Lands that were at first at a level with tidewater have shrunk in the course of years from four to seven feet, until their level has sunk below that of mean low water. When the sea therefore succeeded in flooding such low areas, the possibility of their being reclaimed was practically forever ended. The shrinkage of the soil has manifested itself throughout Holland wherever clay and peat are encountered. It is therefore evident that the level of the land of the Holland of today is many feet lower than it was at the time of the Romans, when the first dike was built. The level of the provinces of Zeeland and Holland ranges between two and six feet below mean high water, while that of the drained areas is much lower, reaching a depth in some cases of 20 feet below mean high tide. Reclaiming land from flats in shallow waters has also been practiced in the northern provinces of Friesland and Groningen, though not as extensively as in Zeeland.

THE CHARACTERISTICS OF THE DUTCH DIKES

The problem of building dikes in a country possessing a soil which offers so little choice in the way of building material as does Holland is to any one but a Dutchman very perplexing. The country has not a single quarry, nor is loose rock available; the few woods that exist are being preserved with great care, and no timber can be cut from them for lumbering purposes. All that the soil of Holland offers is in the form of sand, gravel, and clay, for peat is worse than useless in construction works; and not only are the available materials poor, but suitable foundations upon which to erect dikes or, for that matter, any structures whatever, are totally absent. This is the problem that has been solved by the Dutch engineers through generations and generations of experience.

It is not within the scope of this paper to describe the many different kinds of dikes in use: their forms vary as circumstances require, and a lengthy discussion of them would lead into endless technical details. In brief, the principal features may be described as follows:

Compared with similar structures elsewhere, the Holland dikes are noteworthy for their great width; the river dikes are built with a crown, usually of from 15 to 20 feet wide, while the common type of the Mississippi levees has only a crown width of 8 feet, the height being about the same. The slopes are gentle, a common grade on the water side being three and a half to one, and on the land side two to one. A characteristic feature of the Dutch river dikes is what is technically known as the "banquette," a sudden widening of the dike near its base, which serves to reinforce the dike, and is specially designed to insure imperviousness where the hydrostatic pressure is greatest. The banquettes are built on either side of the dike, and vary in width from 10 to 30 feet. The larger river dikes range in height between 10 and 16 feet above the adjacent land, while the level of their banquettes is 8 feet below the top of the dike.

The materials used in their construction are sand and clay, and in the case of the ordinary dikes the water side is rendered impervious by means of a heavy layer of stiff clay. As a rule, no special preparations are made for the foundations, except where the soil is of a very treacherous character, when fascine mattresses laid in tiers are used, in very much the same manner as along the Mississippi. Wherever riprap or stone revetments are required, as, for instance, on the sea dikes, where the erosive action of the surf is considerable, basalt blocks brought from Germany are laid on heavy layers of brush. In many places piles are driven at the base of the sea dikes in order to break the violence

of the breakers. Nearly all masonry in engineering constructions is of Dutch brick, which is of a very superior quality. In breakwaters or piers, however, concrete blocks are used exclusively, as neither bricks nor basalt would furnish a bond strong enough to withstand the impact of the waves.

ENGINEERING PROBLEMS

From a hydrographic point of view, the Netherlands present a very unusual spectacle. While the eastern elevated portion has a natural topography of its own, and consequently natural lines of drainage, the western lowlands are devoid of all drainage whatever, and every drop of rain water that falls, as well as all seepage water, must either evaporate or be pumped up and discharged through artificial means into the ocean, if accumulations and inundations are to be prevented.

Statistics show that in 1896, 2,519 square miles of polder land were being maintained with the aid of 444 steam-engines and 247 windmills; 1,234 square miles were being maintained with the aid of 1,706 windmills, or in all 2,397 pumping plants were required to drain 3,753 square miles.

What at one time were natural channels and water-courses have been since inclosed between dikes, and the level of their waters is now higher than that of the adjacent land. The large rivers that flow through these low districts are therefore here no longer rivers in the strict sense of the word, as the features and problems which they present are very distinct from those characteristic of natural streams. The smaller streams have in reality ceased to exist as such. For instance, the northern branch of the Rhine, along which general Drusus caused a levee to be built, is no longer a river; its waters no longer flow; it is

Forest Growth on the Dunes

The Dunes near Domburg, in the Province of Zeeland

nothing but an artificial channel, held between embankments and divided into a series of sections closed by means of locks. No longer does it empty its waters into the sea at Katwijk, where the light-house of Caligula once stood on an island in its estuary; but when the lock-tender at that point has orders to do so, some of its waters are allowed to escape at low tide when it is considered perfectly safe. The same condition is true of the smaller streams of the polder lands. Protected on the sea side by the dunes and dikes and partitioned off in the interior by an endless array of dikes which skirt the water-courses and canals, surround polders, and also serve as embankments to railroads and highways, Holland partakes much of the nature of a huge ship with water-tight compartments.

The immense amount of engineering which is required to keep up this complicated system of dikes and waterways has always been a source of interest to technical men in other countries. No haphazard guesses are made as to the amount of water permissible in any particular waterway, nor as to the height or size of dikes required. Matters of this nature are determined with great nicety through the accumulations of past experience. As one waterway is frequently made to relieve another and the number of combinations must be varied as circumstances require, a knowledge of the fluctuations in the levels of all bodies of water becomes paramount. In order to supply this information, no less than 172 gage rods are maintained throughout the kingdom along the coasts, at estuaries, on large rivers, on canals, bosoms, and small streams, and a few even are located in foreign countries, as, for instance, the gage on the Rhine River at Cologne, Germany, which

has been maintained there by the Dutch Government since 1772. In order to derive the greatest possible use from the data so obtained, all the gage rods in the kingdom are referred to the same baselevel, mean high water, generally denoted by the symbol AP, and the heights of water thus indicated by them give directly the elevation of the water-levels with respect to that of mean high water of the sea.

The present kingdom has an area very nearly equal to the combined areas of the States of Connecticut and New Jersey.

Connecticut.....	4,990 square miles.
New Jersey.....	7,815 square miles.
Netherlands	12,738 square miles.

About 59 per cent of this area consists of alluvial formation, and is inclosed by dikes and provided with artificial drainage. There are, therefore, about 7,515 square miles of lowlands, very nearly equivalent to the area of the State of New Jersey, while the remaining highlands would cover an area about equal to that of the State of Connecticut. The discharge of the Rhine at the point where it enters the country is similar to that of the Tennessee River, while the flow of the Meuse may be compared with that of the Potomac.

SMALL AVERAGE RAINFALL IN THE NETHERLANDS

As a large part of the Netherlands is drained artificially, a few words concerning the rainfall will be of interest. The country enjoys the unenviable reputation of possessing a wet soil and a still wetter atmosphere. Both of these attributes are popular exaggerations. The atmosphere of the Netherlands is frequently moist—that is, it contains at times a high relative humidity—but the rainfall nevertheless is moderate, not to say small. As compared with the United States, it will be found that the amount of precipitation that occurs annually in the Netherlands is about the same as that of the Great Plains region. The normal precipitation for the Netherlands, as derived from observations extending over more than a century, is about 26 inches per annum, or only 5 inches more than half of the amount of rain that falls annually in Washington, D. C.; and, in spite of the reputed moist atmosphere of the Netherlands, the evaporation during the early summer months exceeds the precipitation.

*Table of Evaporation and Precipitation from Observations Made at Zwanenburg, near Amsterdam, During 1743–1843.**

Months.	Normal precipitation.	Normal evaporation.	Excess— Precipitation.	Excess— Evaporation.
	Inches.	*Inches.*		
January.....	1.49	0.33	1.16	.....
February.....	1.46	0.57	0.89	.....
March.....	1.43	1.37	0.06	.....
April.....	1.49	2.39	.....	0.90
May.....	1.56	3.26	.....	1.70
June.....	2.09	3.74	.....	1.65
July.....	2.69	3.74	.....	1.05
August.....	2.97	3.25	.....	0.28
September.....	2.82	2.16	0.66	.....
October.....	3.09	1.24	1.85	.....
November.....	2.76	0.70	2.06	.....
December.....	2.03	0.53	1.50	.....
Total.....	25.88	23.28	8.18	5.58

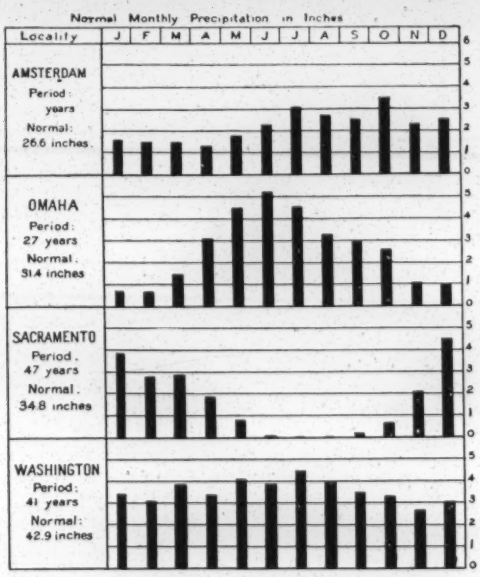
In other words, there is a decided dry season, during which droughts are by no means uncommon. In order to keep the water in the ditches at the proper level, to prevent plant-growth from suffering during such droughts, an efficient remedy is found in allowing the water in surrounding bosoms and canals to run back into the polders, and the usual process of their maintenance is thus actually reversed.

The polder lands known as Rijnland,

*From A. A. Beekman, *Nederland als Polderland*, p. 100.

an area of 417 square miles, it is estimated consume annually no less than 90 millions of cubic meters of water from adjacent rivers.

The climate of the Netherlands presents therefore an interesting anomaly. In spite of its small rainfall it does not exhibit any of the characteristic features of a semi-arid country, with the exception of some sandy, barren areas which are incapable of producing anything and are actually to be classed as desert

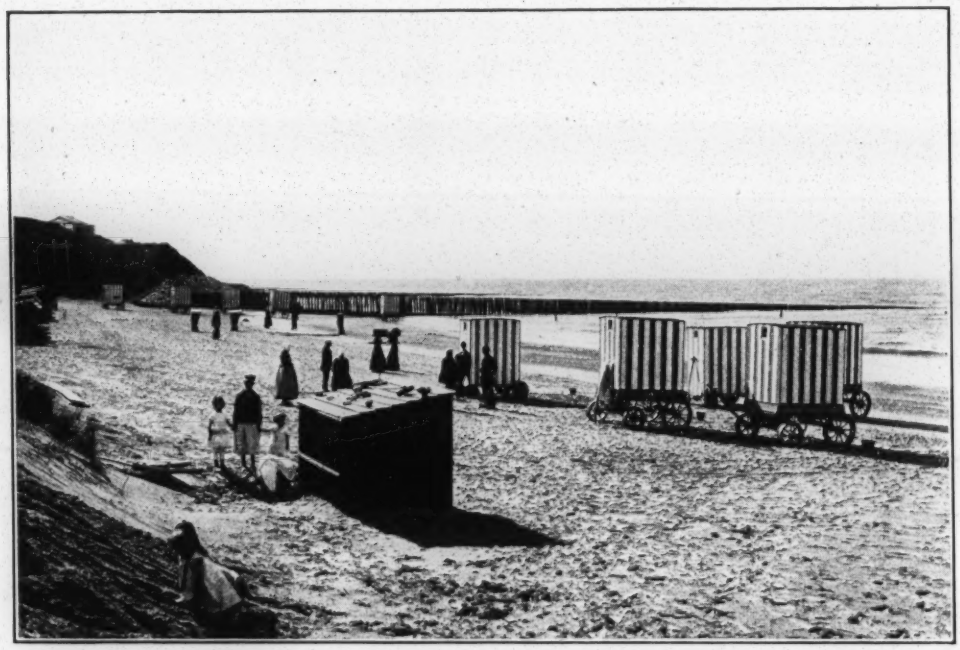


lands. Though an equal annual rainfall in the Great Plains region is not sufficient to produce forest growth, the Netherlands were practically entirely forest-clad at a period not so very remote, and probably would be so now but for the deforestation which has naturally attended its settlement. This anomaly is easily explained by three factors: the consistency of the Dutch soil, which renders it capable of absorbing and holding large quantities of water; the inexhaustible perennial streams and other bodies of water that feed it, and last, but not least, the even distribution of the rainfall throughout the year. The lack of ample precipitation is thus more than offset by the humid condition of the soil, which makes aridity impossible.

After reviewing all the difficulties and perils with which the Hollander has had to contend in the building up of his country, it at first sight appears strange that he should ever give up any portion of his valuable lands to the dangerous element that he has for centuries fought so desperately. But as in the course of the history of every nation it sometimes becomes necessary that the welfare of one or more individuals should be sacrificed for the good of the country or of the world at large, so there are times when the people of the Netherlands do not hesitate to cause large areas of land to be inundated in order to save what is dearer and more valuable. Recourse is had to such practice during the season of high waters on the rivers and also during times of war.

MEANS OF PROTECTION AGAINST FLOOD DISCHARGES

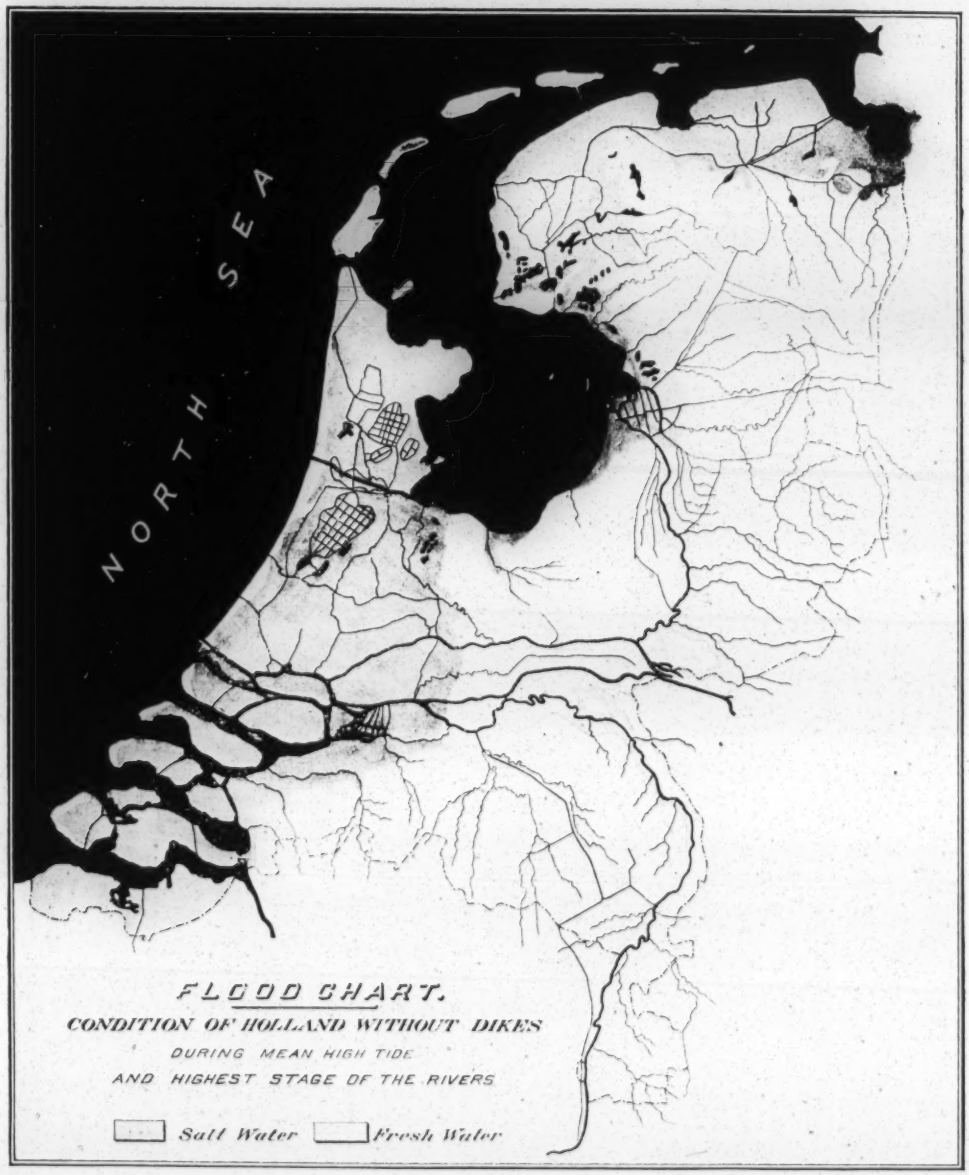
The rivers that flow through the Netherlands, like most streams of the northern hemisphere that flow in a northerly direction, are subject during the early spring months to ice jams and sudden flood discharges along their lower courses—a condition well nigh inevitable, as their waters flow from a warmer to a colder climate. In the Netherlands the Rhine, owing to the many channels into which it divides, can be controlled with far greater security than the Meuse, which, though a much smaller river, has a greater fall, and in its narrow, tortuous bed becomes when swollen a source of great danger, threatening to overtop its dikes. Sandbags and the many other devices employed so extensively in similar cases of emergency along the Mississippi levees are then used, but the most efficient relief



Pile Dikes for Protection against Marine Erosion

is afforded by allowing the swollen river to discharge a large part of its burden into the adjacent country. This is effected by providing at suitable points low dikes over which the water will run on reaching the danger line. These low dikes or weirs, known in Dutch as "overlaten," might well be compared to safety-valves. Their location is chosen in such a manner that the water discharged into the open country will do comparatively little harm, and, being confined by dikes especially designed for that purpose, is made to find its way to some low point farther down the river or near the latter's mouth.

Overlaten existed many years ago on all the large rivers, and although their use has saved the country much damage and expense, it has proved a serious evil in another way. It is obvious that whenever a river at the flood stage is deprived at some point along its course of a large share of its burden the natural consequence is a lessening of the current below such a point and the depositing of a vast amount of sediment. Not only is this deposition of sediment at a time when the river transports a maximum amount a very serious evil, but the slackening of the current also offers most favorable conditions for the formation of ice jams. During the past years all the overlaten have been abolished with the exception of one on the Meuse, known as the Beerse Overlaat, which exceeds two miles in length and has been known to discharge with a head of three feet during severe floods, the river at such times being relieved of more than a third of its total flow. The policy at present is to increase the capacity of the river channels by deepening and widening the mouths, and in-


NORTH SEA
FLOOD CHART.
CONDITION OF HOLLAND WITHOUT DIKES
DURING MEAN HIGH TIDE
AND HIGHEST STAGE OF THE RIVERS
Salt Water
Fresh Water

creasing their fall by regulating and dredging their beds. The amount of dredging annually by the government and by private parties reaches a very considerable figure. Nearly all of the sand and gravel used in dike-construction is obtained from the river bottoms by dredging.

THE DIKES A SYSTEM OF NATIONAL DEFENSE

In conclusion, a word should be said about the practice of inundating lands for defensive purposes. The efforts of the Dutch to flood their country, as described in Motley's *Rise and Fall of the Dutch Republic*, and later again in 1672, at the time of the war with France, are well known to those familiar with the history of the Netherlands. The methods employed in those days were not as successful as they might have been, and the blunders that were committed would have led to disastrous results but for the greater ignorance displayed by the attacking party. Thus, in 1672, the French army of invasion could not be prevented from draining some of the inundated lands, although their lack of knowledge of the complicated situation did not permit them to succeed at the time. When cold weather set in the manipulation of the water by the Dutch was so defective that large areas were allowed to freeze over, and the enemy was actually enabled to execute movements on the ice.

The enormous strength of defensive works of this class was, however, amply proved and the Government at the present day has provided an elaborate system for flooding, which forms part of the military defenses of the lower provinces. Lands to be flooded are provided with special gage rods or bench-marks indicating the depth of water required in order to be effective. Special gates have been constructed in the dikes where water is to be turned onto the land, in order to avoid the slow and undesirable process of piercing dikes. The amount of water that is to be drawn for such purposes from bosoms and canals, the discharge that is to pass the gates in a given time, and the ultimate time required to flood a particular area to a certain depth are quantities that have been determined for each section of land with a nicety which no one can fail to appreciate who is familiar with hydraulic computations of the flow of water in open channels and through orifices.

There are at present about 1,000 miles of sea dikes in the Netherlands. The total length of dikes is difficult to estimate, and even if it could be estimated would mean but little, for it must be remembered that the dikes have for the most part in the course of time been destroyed and rebuilt repeatedly. It has not been so much a question of building them as it has been of maintaining them and keeping them where they were. Besides protecting the country from the invasions of both fresh and salt waters, the dikes have served to reclaim no less than 210,000 acres, nearly all of which are good, fertile land. It is to be hoped that the stupendous project of reclaiming the Zuider Zee will some day be carried into effect, whereby there would be added to the kingdom some half million acres of land.

MEXICO OF TODAY*

By Senor Dr. Don Juan N. Navarro, Consul-General of Mexico in New York City

THANKS to intelligence and honesty in the administration of our finances, the continual annual deficit that formerly afflicted Mexico, as it afflicts at present other nations, disappeared in the fiscal year 1894–'95, and in its stead we have since had a surplus. The surplus in that year was $2,373,434.42, and in the following year more than doubled, rising to $5,451,347.29.

These results are the more surprising when it is remembered that a good part of our revenue is derived from import duties, and it might be supposed that the rapid development and progress of our industries would diminish that source of revenue.

The invoice value of our imports for 1896–'97 was $42,204,095 in gold. Three years later, in 1899–1900, they had increased by nearly one-half, reaching $61,318,175. The invoice value of our exports (in silver) amounted to $86,058,210 in 1892–'93, to $104,741,443 in 1896–'97, and to $142,615,070 in 1899–1900. The value of gold exported from Mexico in 1892–'93 was $1,451,011, and during the next seven years increased many fold, reaching $7,441,290 in 1899–1900.

At the end of the fiscal year 1898–'99 the federal treasury had a surplus in cash of $27,535,602.62. Because of this prosperous condition of the treasury the taxes were reduced, and a part of the funds were applied to branches of public service:

For building primary schools in the federal district and for the corresponding departments	$1,000,000
To finish the general hospital	500,000
For the building of the medical and geological institutes	200,000
For a new post-office in the capital and for the post-offices of Vera Cruz and Puebla	$1,000,000
For a cable between the peninsula of California and the coast of Sonora	300,000
For the Navy Department	1,000,000
Total	$4,000,000

To prove the financial credit of Mexico in the world, I will mention the conversion of our public debt from an interest rate of 6 per cent into another of 5 per cent. The contract for this operation, executed personally by our intelligent minister of finance, and involving a loan of 22,700,000 pounds, was signed in Berlin by different banking-houses from that city, London, New York, and the national bank of Mexico, on July 1, 1899. The conditions were as favorable as could be offered to any nation of well-established credit, and in the short time open for subscriptions the public of London, Amsterdam, New York, and Berlin subscribed for nearly twenty millions of pounds instead of for the 13,000,000 offered in the markets of those cities. The advantages for our treasury are not only the reduction of the disbursements for interest, a reduction amounting annually to more than $1,800,000, but the reëntry into the treasury of values mortgaged before as securities.

To give the last proof of the credit of Mexico, I will add that the bonds of the new loan began to be sold above par only a few months after they were issued.

The laws issued by the department on institutions of credit have produced good effects, and in November last we had 18 banks of emission, with a paid-up capital of $52,900,000, and with notes in

* Concluded from the May number.

circulation to the value of $65,897,100. Recently, on account of the war in China and the Philippine Islands, many millions of Mexican dollars have been exported, producing a certain stringency in the Mexican money market. The evil is not great, and it will disappear totally, owing to the opportune measures taken by the government and the prudent and conservative policy of the banks.

A few words now about our War and Navy Departments.

I admire the peace congresses, the anti-war speeches and sermons, but my opinion is that those well-intentioned persons lose their time, as there will always be war, because we cannot change the intimate nature of mankind, and universal and perpetual peace is a mathematical limit, to which mankind can approach but never touch, as then humanity would cease to be what it is.

The barbarism of war, the injustices and atrocities inseparable from it, are truths within the knowledge of every civilized man; but as long as there will be human passions, as long as there will be a great difference of strength among nations, there will be war. I think that there is a practical and efficient method, if not to extinguish what is an impossibility, at least to make international wars very rare, and that is to invent something equalizing as much as possible the strength of the different peoples, leveling to the greatest possible extent the weak with the strong. The invention of dynamite and other explosives, the great improvements in hand arms and in the artillery, under equality of circumstances favor more the defense than the attack, and are therefore in favor of the weak, and are producing in favor of peace and justice an excellent and practical effect. I say justice, because in the majority of cases justice is on the weak side.

An army is a necessity. Justice is represented by the image of a girl having a balance in her left hand and a sword in the right, and unfortunately, but truly, she is obliged to use the sword more than the balance.

Armies at the beginning and the middle of the last century were in many cases bodies of men with interests and exigencies opposite to those of the nation's supporting them.

In our times good armies must be bodies of armed men, taught not only military exercises, but to know that the law is superior to everything; that they form a part of the nation of whom they are servants and not masters. Every citizen must be a soldier, because every citizen has the ineludible duty of keeping peace and order in the interior and repelling the foreign invader. That, it seems to me, is the only way of forming and keeping an army, especially in a country ruled by republican institutions.

In Mexico experience has conclusively shown that officers and even soldiers cannot be improvised, and the very first care of General Diaz has been to establish a good school for instructing scientific officers. The military school of Chapultepec in its actual condition is the fruit of his efforts. Many foreign officers of different nationalities have visited that establishment and believe that it ranks among the first in the comprehensiveness and perfection of military instruction there imparted and in the severe but just discipline to which the cadets are subjected.

From that institution are graduated all the officers of our army, and new rules have been recently issued to prevent the abuse committed by some persons who go there to receive a good and gratuitous education without any intention of serving in the national army.

In the capital and in many other places commodious barracks, affording comfort and good hygienic conditions to the soldiers, have been constructed or are in the course of construction. The soldiers are armed with weapons

pronounced to be the best by technical commissions after long, conscientious, and severe trials, and our artillery includes some pieces of a system invented by one of its best officers, Colonel Mondragon.

The cavalry is composed of excellent riders, very easy to find in Mexico, and provided with horses selected expressly for military service.

The barracks are not as before—places for keeping the soldiers—but schools where reading, writing, and elementary arithmetic and different trades are taught. The troops are subject to the strictest discipline, but at the same time the inferior has always within his reach the means to redress an injustice or to prevent or have punished an ill-treatment from his superior. The military code has been one of the works to which the government has particularly directed its attention, to put it in perfect harmony with justice and the republican institutions ruling the country. The ambulance and hospital branch receives continual additions to its equipment, and is formed from many of the best surgeons and physicians. Experience has proved its efficiency. There are officers selected by the government studying in foreign countries, and their observations are applied to the improvement of our army.

Very recently the government has issued a decree for the reorganization of the army, with the object of keeping in active service the same number of troops we have now, but of supplying the means to increase that force to the extent of some hundreds of thousands in time of necessity, and adding as a reserve the whole nation in the case of a foreign invasion.

Our navy is in its infancy, but the flotilla we have around Yucatan to provision the land troops and to coöperate with them and to subdue those of the Maya Indians who refuse to obey the laws regulating a civilized community is rendering invaluable services. Little by little the number and size of our war vessels will be increased, as our government never loses sight of that important branch of national defense.

To conclude, Mexico is a country endowed with many natural gifts, ruled by a wise government and republican institutions equal to the United States in essential points, inhabited by 14,000,000 intelligent, peaceful, and industrious people, remarkable for their natural courtesy and hospitality, which is extended to all without distinction of nationality.

Mexico cultivates friendly relations with the whole civilized world, and is in the most intimate intercourse with the Government and people of the United States.

The governors of the States, into which the Republic is divided, coöperate intelligently with the federal authorities to establish and maintain all moral and material improvements.

There is a complete and constantly improving system of public education, uniform in the country, which is making education compulsory and gratuitous, and the schools, nearly 13,000, are attended by numerous pupils, and the extension of elementary knowledge to the lowest classes of our people is the best proof of the methods employed.

Industry in all its branches is growing at a worderful pace, and the number of manufactories is in constant progress and their products are of a high grade.

The means of communication are numerous, there being in actual operation more than 9,000 miles of excellent railroads, and more than 61,000 miles of telegraphic and telephonic lines, and different submarine cables for communication with every civilized nation.

The national and international postal system is now very good and growing continually to a degree of great perfection.

The national treasury is in a flourishing condition, and we Mexicans can say

with pride that it is administered with consummate ability and perfect honesty.

Finally, we are in perfect peace, and there is not a single cloud on our political horizon, and therefore it is the time to form upon solid foundations our army and military institutions, following the old Roman maxim, as true today as in the times of Cæsar, "In time of peace prepare for war."

The Mexican people have fought for their independence against great odds, with poor arms, without a cent, and having scarcely the necessary food to maintain life, and have fought incessantly till they have come out victorious. That same people, well armed, with abundant pecuniary resources, and guided by good scientific officers, are preparing for their future and unknown invaders some little surprises probably beyond the expectation of the attacking party.

I have lived in your powerful and interesting country for more than thirty-seven years, receiving uninterrupted proofs from the authorities and people of esteem and consideration, and I avail myself of this occasion to make manifest my heartfelt thanks for so much kindness.

May your Republic be always prosperous, guided by the sublime maxims of its immortal and virtuous founder, who condensed all his wise advice to his people in those five words of eternal truth, "Justice is the best policy."

SIR JOHN MURRAY

SIR JOHN MURRAY has recently returned from a six months' expedition to Christmas Island, a tiny isle 200 miles south of Java, and has thus added one more to his many interesting explorations. Sir John was born in Coburg, Ontario, Canada, on March 3, 1841. He received his early education at a public school in London, Ontario, and at the Victoria College, Coburg, Ontario; but when a youth he removed to Scotland, where his education was continued at the High School of Stirling and at the University of Edinburgh.

In 1868 he took a voyage in an Arctic whaler to Spitzbergen and other places in the Arctic regions. In 1872 he was appointed as naturalist on the civilian scientific staff of the *Challenger* Expedition, and in that capacity accompanied H. M. S. *Challenger* during her scientific circumnavigating cruise from 1872 to 1876. On the return of the expedition he became first assistant, under Sir C. Wyville Thomson, on the commission appointed to prepare the scientific results for publication, and in 1882, owing to the failing health of Sir C. Wyville Thomson, he was appointed editor of the "Challenger Reports." These "Official Reports on the Scientific Results of the Voyage of H. M. S. *Challenger*" filled fifty large royal quarto volumes, and were published at intervals as ready, the first volume appearing in 1880 and the final volumes in 1895. Besides editing nearly the whole series, Sir John Murray was joint-author of the "Narrative of the Cruise" and of the "Report on the Deep-Sea Deposits," and author of a "Summary of the Scientific Results," in two volumes. The British Government has presented copies of these reports to scientific institutions and learned societies in all quarters of the globe.

In addition to superintending the work of publishing the "Challenger Reports," he has during the past thirty years published a large number of papers on oceanographical, geographical, geological, and other subjects,

Sir John Murray

many of them of great interest and scientific value, in which he has expressed some novel and ingenious ideas respecting the past and present condition of our planet.

In 1880 Sir John Murray took part in a scientific exploration of the Faroe Channel, between the north coast of Scotland and the Faroe Islands, in H. M. S. *Knight Errant*, and again in 1882, in the same region, in H. M. S. *Triton*. He was for several years scientific member of the Fishery Board for Scotland, and in 1899 he was appointed a delegate of the British Government at the International Fisheries Conference at Stockholm. He also acted as president of the Geographical Section of the British Association for the Advancement of Science, Dover, 1899.

During eight or ten years he was engaged in a bathymetrical and biological survey of the coast of Scotland in his small steam yacht, the *Medusa*, in which work he was assisted by many scientists. He has also taken an active part in the foundation of marine stations for physical and biological research at Granton, near Edinburgh, and at Millport, on the island of Cumbrae, in the Firth of Clyde, as well as in the foundation of the meteorological observatories on the summit and at the foot of Ben Nevis, the highest mountain in Scotland.

Christmas Island was added by England to the colony of the Straits Settlements in 1889, and is some 12 miles long by seven broad. It has rich phosphate deposits, which are worked by an English company. The works give employment to about 700 coolies and a score of whites, but is believed never to have been inhabited prior to the English annexation.

In recognition of his scientific work Sir John Murray has been awarded the Cuvier prize of the Institute de France, the Humboldt medal of the Gesellschaft für Erdkunde zu Berlin, the Royal medal of the Royal Society, the Founder's medal of the Royal Geographical Society, the Keith and the Makdougall-Brisbane medals of the Royal Society of Edinburgh and the Cullum medal of the National Geographic Society of Washington.

GEOGRAPHIC NOTES

POPULATION OF UNITED KINGDOM

FORTY-ONE and one-half millions of people are now crowded into the United Kingdom. A similar density of population in the United States would mean a total population in this country, excluding the dependencies, of about 1,036,000,000.

For the last ten years England and Wales show a rate of increase of 12.15 per cent, which slightly exceeds their rate of growth for the preceding decade, 11.65 per cent; Scotland, a rate of increase of 10.8 per cent, also a greater increase than during the preceding decade, and Ireland a rate of decrease of only 5.3 per cent, which is little more than one-half the rate of decrease of the preceding decade. The census figures are thus very gratifying to Englishmen, for they show no signs of diminishing national vitality, but rather tend to show increasing national virility. It is yet too soon to give exact percentages of the relative growth of the urban and rural districts, but what figures have been given show a most marked increase in city populations.

The population of England and Wales is now 32,525,816, of Ireland 4,456,546, and of Scotland 4,471,957, making a total population for the United Kingdom of 41,454,219.

POPULATION OF AUSTRALIA AND NEW ZEALAND

THE recent census of Australia, according to cabled reports, shows that the population of this great confederation has increased about 16.9 per cent in the last ten years, or 514,000 in round numbers, which exceeds the rate of growth of England, but falls much behind that of the United States. The present population of the island continent is 4,550,651 as against 4,036,570 in 1891. Apparently the Australians are spreading out more, for all the cities except Sydney show a less comparative increase than the country districts. Melbourne, for instance, since 1891 has added only 3,000 to her inhabitants and now numbers 493,956. Sydney ten years ago had a population of about 385,000, but the city has grown very rapidly and now is only a few thousand behind Melbourne. Victoria has given way to New South Wales as the most populous colony, though the former is still the most densely populated. Victoria has a present population of about 1,196,000, and New South Wales of 1,362,232.

New Zealand has added 146,000 white persons to her population, so that today there are 773,000 white people within her borders. Her rate of growth for the preceding decade is thus 23 per cent, which would tend to show that her radical social laws attract immigrants, notwithstanding the very high *per capita* debt of the government. Including the Maori, the population of New Zealand is 816,000.

THE CENTER OF POPULATION OF THE UNITED STATES

A POINT in the interior of the earth 600 miles beneath the city of Nashville, Tenn., has been computed by Mr. Henry Gannett as approximately the center of population of the United States and its dependencies, including Alaska, Cuba, Porto Rico, and the Philippines. In other words, the center is beneath the intersection of the 36th parallel with the 87th meridian.

In computing this center of population it is necessary to regard the earth as a sphere rather than a plane surface, for Porto Rico and the Philippines are nearly half the earth's circumference apart.

But if Alaska and the recent territorial acquisitions be disregarded, the center of population of the United States is six miles southeast of Columbus, in Bartholomew County, Indiana. In the ten years preceding June 1, 1900, the center of population has thus moved westward 14 miles and southward two and one-half miles, the smallest movement ever noted by the Census Bureau.

It shows the population of the Western States has not increased as rapidly as in former decades. The southward movement is due largely to the great increase in the population of Indian Territory, Oklahoma, and Texas, and the decreased westward movement to the large increase in the population of the North Atlantic States.

The center of area of the United States, excluding Alaska and Hawaii and other recent accessions, is in northern Kansas. The center of population, therefore, is about three-fourths of a degree south and more than 13 degrees east of the center of area.

SERVIA

THE little kingdom of Servia, the actions of whose monarch and his consort have aroused so much comment during the past year, is about the size of the States of New Hampshire and Vermont combined. Surrounded on all sides by foes or unreliable friends—Bulgaria on the east, Turkey on the south, Roumania and Austro-Hungary on the north and west—its life since it became a semi-independent nation has been a

hard one, especially as it has not known how to protect itself against attacks which its own deceitful arrogance has aroused.

The country is mountainous and hilly, without any of the mountains, however, attaining great height. Mt. Midzur, on the eastern boundary, with a height of 7,106 feet, overtops all others in the kingdom. The mountains of Servia are the ramifications of four systems which invade the kingdom from different directions. One branch comes from the east from Bulgaria, a second from the southeast from Macedonia, a third from the south from Albania, and the fourth from the west from Montenegro. Rivers, streams, and rivulets, all flowing in different directions, still further subdivide the country, but between the mountains and along the large rivers are rich and fertile sloping valleys and plains. Two and one-quarter millions of people cultivate all the available land. Servia is distinctly an agricultural country; 83.6 per cent of her people till the soil, and about 85 per cent in value of her exports are cattle and agricultural products.

The climate is temperate and dependent on the winds, which, on the whole, are constant from the northwest and northeast during the winter and from the west and southwest during summer. A temperature of about 25.2° Fahr. during winter and 69.98° during summer is the normal.

Twenty-five years ago, in 1876, Servia was clothed with forests, and was aptly termed "the land of the forest;" but the Servian-Turco trouble of 1876'–78 played havoc with the forests. Thousands of acres were stripped of trees in order to serve for fortifications or to bar the advance of the Turkish army or to warm the great masses of troops that camped on the land during two winters. The war was followed by a period of ruthless destruction of the forests, vast tracts being sold at a ridiculous price or denuded to supply the railroads.

GEOGRAPHIC NAMES

THE following decisions were made by the U. S. Board on Geographic names May 1, 1901:

Goose; point, Chincoteague Bay, Worcester County, Maryland (not Clam).

Hardship; branch of Pocomoke River, Worcester County, Maryland (not Hardshift).

Long; point, Chincoteague Bay, Accomac County, Virginia (not Bodkin).

Nofat; mountain between Buncombe and Madison counties, North Carolina (not No Fat nor No-fat).

Ricks; point, Chincoteague Bay, Worcester County, Maryland (not Rich, Rich's, nor Rick's).

Robin; creek and marsh, Chincoteague Bay, Worcester County, Maryland (not Robbins, Robins, nor Robin's).

Rockawalking; creek, post-office, and railroad station, Wicomico County, Maryland (not Rock-a-walkin).

Scarboro; creek and railroad station, Worcester County, Maryland (not Scarborough's).

Seeley; creek, Sauk County, Wisconsin (not Seely).

*Smoke; creek, south of Buffalo, Erie County, New York (not Smokes).

Taylorville; village, Worcester County, Maryland (not Taylor nor Taylorsville).

Tilhance; creek, Berkeley County, West Virginia (not Tilahanchee, Tilchancos, Tilehance, Tillehances, etc.).

Whittington; point, Chincoteague Bay, Worcester County, Maryland (not Willington's).

PREHISTORIC SURGERY

AN item going the rounds of the press relates to the Muñiz collection of trephined crania from Peru, exhibited at the Pan-American Exposition by W J

* Erroneously given in May number of this Magazine, p. 201, as in Pennsylvania.

McGee. The collection comprises 19 crania, of which several were trephined more than once. The trephined skulls were selected from a collection of 1,000 made by the late Dr. Manuel A. Muñiz in pre-Columbian, and probably pre-Incan, cemeteries in different portions of Peru; and they are of interest as showing that this major surgical operation was more common among the aborigines of South America than in the most highly advanced nations of today.

The ratio of trephined crania is just below two per cent; but since one specimen shows three operations and two others three each, the ratio of trephining to population indicated by the collection is nearly two and one-half per cent. The technic of the operation was critically studied by McGee, and described in a recent report of the Bureau of American Ethnology. It would appear from his researches that the operation was not therapeutic in the ordinary sense of the term, but was thaumaturgic and closely allied to the so-called "medicine" of various tribes, in which the treatment consists of occult ceremonies and skillful jugglery by the shamans.

UNEXPLORED CANADA

ONE-THIRD of the area of Canada is practically unknown, states the Director of the Geological Survey of the Dominion in his last report.

There are more than 1,250,000 square miles of unexplored lands in Canada. The entire area of the Dominion is computed at 3,450,257 square miles; consequently one-third of this country has yet been untraveled by the explorer. Exclusive of the inhospitable detached Arctic portions, 954,000 square miles is for all practical purposes entirely unknown.

Most of this unknown area is distributed in the western half of the Dominion in impenetrated blocks of from 25,000 to 100,000 square miles—that is, areas as large as the States of Ohio, Kansas, or New England are yet a secret to white man.

Beginning at the extreme northwest of the Dominion, the first of these areas is between the eastern boundary of Alaska, the Porcupine River, and the Arctic coast, about 9,500 square miles in extent, or somewhat smaller than Belgium, and lying entirely within the Arctic Circle. The next is west of the Lewes and Yukon Rivers and extends to the boundary of Alaska. Until last year 32,000 square miles in this area were unexplored, but a part has since been traveled. A third area of 27,000 square miles—nearly twice as large as Scotland—lies between the Lewes, Pelly, and Stikine Rivers. Between the Pelly and Mackenzie Rivers is another large tract of 100,000 square miles, or about double the size of England. It includes nearly 600 miles of the main Rocky Mountain range. An unexplored area of 50,000 square miles is found between Great Bear Lake and the Arctic coast, being nearly all to the north of the Arctic Circle.

Nearly as large as Portugal is another tract between Great Bear Lake, the Mackenzie River, and the western part of Great Slave Lake, in all 35,000 square miles. Lying between Stikine and Laird Rivers to the north and the Skeena and Peace Rivers to the south is an area of 81,000 square miles, which, except for a recent visit by a field party, is quite unexplored. Of the 35,000 square miles southeast of Athabasca Lake, little is known, except that it has been crossed by a field party en route to Fort Churchill. East of the Coppermine River and west of Bathurst Inlet lies 7,500 miles of unexplored land, which may be compared to half the size of Switzerland. Eastward from this, lying between th Arctic coast and Blacks River, is a area of 31,000 square miles, or abou

equal to Ireland. Much larger than Great Britain and Ireland, and embracing 178,000 square miles, is the region bounded by Blacks River, Great Slave Lake, Athabasca Lake, Hatchet and Reindeer Lakes, Churchill River, and the west coast of Hudson Bay. This country includes the barren grounds of the continent. Mr. J. B. Tyrell recently struck through this country on his trip to Fort Churchill, on the Churchill River, but could only make a preliminary exploration. On the south coast of Hudson Bay, between the Severn and Attawapishkat Rivers, is an area 22,000 square miles in extent, or larger than Nova Scotia, and lying between Trout Lake, Lac Seul, and the Albany River is another 15,000 square miles of unexplored land. South and east of James Bay and nearer to large centers of population than any other unexplored region is a tract of 35,000 square miles, which may be compared in size to Portugal.

The most easterly area is the greatest of all. It comprises almost the entire interior of the Labrador Peninsula or Northwest Territory, in all 289,000 square miles, or more than twice as much as Great Britain and Ireland. Two or three years ago Mr. A. P. Lowe made a line of exploration and survey into the interior of this vast region, and the same gentleman also traveled inland up the Hamilton River, but with these exceptions the country may be regarded as practically unexplored.

The Arctic islands will add an area of several hundred thousand square miles of unexplored land.

The government during the past year has made a great effort in the direction of exploring and developing this vast territory. It has recognized the fact that railroads are essential to the development of a new country, and liberal inducements for their construction are made by granting millions of acres of land as a bonus.

GEOGRAPHIC PROGRESS IN SOUTH AMERICA

THE governments of the South American Republics are beginning to make an effort to obtain a better knowledge of their vast territories. One hundred years ago South America, next to Europe, was the most accurately known of the continents. Today it is the least known of them all, so rapid has been geographic progress elsewhere and so tardy in South America.

The government of Bolivia has recently taken steps to obtain a complete survey of the country. A Paris firm has engaged to immediately survey and map 40,000 square kilometers and to lay off a triangulation which will enable a complete trigonometrical survey of the country to be made. Bolivia has also arranged with Paraguay for a joint commission to trace and mark the boundary between the two nations. A joint commission with Brazil several months ago commenced surveying the Bolivian-Brazilian line. A school of mines has also been established by the Bolivian Government to train and encourage its own people to the development of its mineral resources.

COMMERCIAL RELATIONS OF THE UNITED STATES

THE Bureau of Foreign Commerce of the Department of State has issued its report on the commercial relations of the United States for 1900. The introduction, by the chief of the Bureau, Frederic Emory, contains several pertinent pages on the present ascendency of the United States:

"Lord Rosebery is quoted by cable as having said in a speech before a British chamber of commerce January 16, 1901, that the chief rivals to be feared by Great Britain 'are America and Germany. The alertness of the Americans,' he continued, 'their incalculable natural

resources, their acuteness, their enterprise, their vast population, which will in all probability within the next twenty years reach 100,000,000, make them very formidable competitors with ourselves. And with the Germans, their slow, but sure, persistency, their scientific methods, and their conquering spirit, devoted as these qualities are at this moment to preparation for trade warfare, make them also, in my judgment, little less redoubtable than the Americans. There is one feature of the American competition which seems to me especially formidable, and as I have not seen it largely noticed, perhaps you will excuse me for calling attention to it. We are daily reminded of the gigantic fortunes which are accumulated in America, fortunes to which nothing in this country bears any relation whatever, and which in themselves constitute an enormous commercial force. The Americans, as it appears, are scarcely satisfied with these individual fortunes, but use them, by combination in trusts, to make a capital and a power which, wielded as it is by one or two minds, is almost irresistible, and that, as it seems to me, if concentrated upon Great Britain as an engine in the trade warfare is a danger which we cannot affore to disregard. Suppose a trust of many millions, of a few men combined so to compete with any trade in this country by underselling all its products, even at a considerable loss to themselves, and we can see in that what are the possibilities of the commercial outcome of the immediate future.'

"It has been evident for some time that the United States, not content with having solved that part of the problem of economy of production which relates to processes of manufacture and the utilization of labor, has been drifting instinctively toward the larger question of the concentration of capital as the logical development of the same general idea of reducing cost and increasing the margin of profit. The question is larger because it has a more direct and more general bearing upon the economic and social life of the nation; upon the interests, real or imagined, of the whole body politic. We have to do with it here only because of its relation to and possible effect upon our foreign trade, and it is interesting to know that so thoughtful an observer as Lord Rosebery perceives in the simplification of the use of capital in the United States which is going on—it may be said experimentally, to a large extent, as yet—a tremendous power in the commercial rivalry of the world.

"Germany, as well as Great Britain, seems fully sensible of the seriousness of American competition. In a recent issue the *Hamburger Fremdenblatt* points out that the United States, which ten years ago exported more than 80 per cent of agricultural products and less than a fifth of manufactured goods, todaydraws nearly a third of its entire export from the products of its factories. 'In other words, the Union is marching with gigantic strides toward conversion from an agricultural to an industrial nation.' Does not the rapid increase of the United States in the value of industrial exports, the *Fremdenblatt* asks, 'constitute an imminent danger for all competing nations?'

"The *Fremdenblatt's* conclusion is that Europe 'must fight Americanism with its own methods; the battle must be fought with their weapons, and wherever possible their weapons must be bettered and improved by us; or, to speak with other and more practical words, Germany—Europe—must adopt improved and progressive methods in every department of industry, must use more and more effective machinery. Manufacturers as well as merchants must go to America, send thither their assistants and workingmen, not merely to superficially observe the methods there employed, but to study them thor-

oughly, to adopt them, and, wherever possible, to improve upon them, just as the Americans have done and are still doing in Europe."

The following table shows the imports and exports for 1900 of all countries for which statistics have been received by the Bureau of Foreign Commerce:

	Imports.	Exports.
United States	$829,052,000	$1,478,050,000
United Kingdom	2,548,260,000	1,725,422,000
Germany	1,388,328,200	1,084,159,200
France (11 months)	773,058,600	719,686,600
Belgium	409,139,500	346,808,100
Austria-Hungary (9 mos.)	280,887,200	317,954,200
Spain (11 months)	123,181,100	101 868,500
Servia (9 months)	7,687,000	8,778,900
Russia (8 months)	119,110,200	210,807,000
Switzerland	214.8 0,000	164,000,000
Italy (11 months)	275,792,300	237,367,100
Greece (3 months)	5 690,700	3,894,900
Mexico (1896–1900)	61,304,900	71,396,600
Canada (1899–1900)	182,951,400	175,656,900
British India (1899–1900)	293,345,200	374,163,900
British Guiana (1899–1900)	6,129,800	9,254,200
Cuba (1899–1900)	71,681,200	45,228,300
Philippines (1899–1900)	20,597,100	19.751,100
Porto Rico (10 months ended April, 1900)	8,730,600	4,594,400
Japan (10 months)	124.261,200	81,146,800
Egypt (10 months)	54,029,100	63,350,900
French Guiana (6 months)	1,648,800	1,388,300

U. S. GEOLOGICAL SURVEY

THE U. S. Geological Survey has assigned the following field parties for work during this season:

Arizona: T. A. Jaggar, Waldemar Lindgren, J. M. Boutwell, F. L. Ransome, John D. Irving, and R. T. Hill.

Arkansas: George I. Adams.

California: George F. Becker, W. Lindgren, J. C. Branner, J. S. Diller, Geo. H. Eldridge, and H. W. Turner.

Colorado: C. W. Cross, Ernest Howe, J. Morgan Clements, S. F. Emmons, John D. Irving, and George I. Adams.

Connecticut: William H. Hobbs and H. E. Gregory.

Delaware: R. D. Salisbury and George B. Shattuck.

Georgia: Arthur Keith.

Idaho: Bailey Willis.

Indiana: George H. Ashley.

Indian Territory: J. A. Taff and George I. Adams.

Kansas: W. S. Tangier-Smith.

Kentucky: M. R. Campbell and George H. Ashley.

Louisiana: George I. Adams.

Maryland: Continuation of cöoperative work as in previous years; William B. Clark, E. B. Matthews, and George B. Shattuck; study of ancient crystalline rocks, paleozoic stratigraphy, and coastal plain deposits.

Massachusetts: B. K. Emerson.

Michigan: Frank Leverett, F. B. Taylor, C. R. Van Hise, C. K. Leith, and W. S. Bayley.

Minnesota: C. R. Van Hise and J. Morgan Clements.

Missouri: W. S. Tangier-Smith.

Montana: Continuation of special studies in the Rocky Mountains; Charles D. Walcott, director; W. E. Weed, and Bailey Willis.

Nevada: G. K. Gilbert.

New Jersey: R. D. Salisbury and George B. Shattuck.

New Mexico: George H. Girty, R. T. Hill, and C. W. Cross.

New York: L. C. Glenn, T. N. Dale, and J. F. Kemp.

North Carolina: Arthur Keith.

North Dakota: N. H. Darton and C. M. Hall.

Ohio: Charles S. Prosser.

Oklahoma: J. A. Taff.

Oregon: J. S. Diller.

Pennsylvania: Parts of Butler, Armstrong, Indiana, Washington, Westmoreland, Fayette, and Tioga Counties, M. R. Campbell, A. C. Spencer, George B. Richardson, and L. Fuller; northern Pennsylvania, George H. Girty; Philadelphia and vicinity, Prof. Florence Bascom and C. R. Van Hise; refractory clays of Pennsylvania, C. W. Hayes; Fulton and Franklin counties, George W. Stone; coal measures, C. D. White.

South Carolina: Arthur Keith.

South Dakota: N. H. Darton and J. E. Todd.

Tennessee: Arthur Keith.

Texas: R. T. Hill and George I. Adams.

Utah: G. K. Gilbert.
Vermont: T. N. Dale and J. E. Wolff.
Washington: F. L. Ransome and Geo. Otis Smith.
West Virginia: Coöperation with State survey under Prof. I. C. White; Wayne county, M. R. Campbell, survey of Ceredo quadrangle.
Wisconsin: C. R. Van Hise and W. C. Alden.
Wyoming: W. C. Knight, N. H. Darton, George I. Adams, and Arnold Hague.

Dr. Gregory, who was to have had charge of the scientific work of the British South Polar Expedition, has resigned his connection with the expedition. Friction between the naval and scientific staffs is believed to be the cause of his withdrawal.

Gen. A. W. Greely, Chief Signal Officer U. S. Army, will make a general inspection of the signal service in the Philippine Islands during the present season. The larger islands of the archipelago are now connected by cable, and each has a telegraph system which includes most of the larger towns.

The U. S. Biological Survey will this summer continue the study of the geographic distribution of animals and plants in Texas. The Survey has been engaged in the work for several years, and in due time will issue maps showing the life zones and faunal areas in the State. Mr. Vernon Bailey has charge of the work and has already begun field operations in southwestern Texas.

Exploration of the Sea.—A meeting of representatives of all the countries bordering on the Baltic and North Seas, excepting France, was recently held in Christiania to confer on the programme for the exploration of the seas between Greenland, Iceland, and Norway. Each of these nations will have a special section assigned to it for study, so that a complete knowledge of the currents, sea bottoms, etc , may be soon obtained. The Norwegians and Russians have already equipped special steamers to carry out their share of the work, and work on the German vessel which is building for the same purpose is well advanced.

The Bureau of American Republics has published two handsome maps of Mexico on the scale of 50 miles to the inch. The first map, besides being a general map of the country, by colors shows the elevation of every part of the Republic. It also gives the agricultural features, showing what sections are wheat-growing, what are favorable to the great Mexican staple henequen, etc. The second map shows the distribution of minerals throughout the country as far as prospecting has revealed their location. These maps are the result of much research, combining all the results of latest surveys. The Bureau announces that similar maps of all the Central and South American Republics are in course of preparation. The map of Brazil is nearly completed, and work on the maps of Guatemala and Costa Rica well advanced.

The Royal Geographical Society has this year awarded the Founders' medal to the Duke of Abruzzi for his two feats of being the first to ascend Mt. St. Elias and of gaining what is now "farthest north," 86° 33′. The expense of each of these expeditions was borne mainly by the Duke, though his uncle, the late King Humbert, generously aided him. The Society has awarded the Patrons' medal to Dr. A. Donaldson Smith for his explorations in Central East Africa in 1894–'95 and 1898–1900. Dr. Smith traversed the last densely inhabited area remaining unexplored in Africa—the country between Lake Rudolf and the White Nile. Awards have

also been made by the Society to Captain Cagni, of the Duke of Abruzzi's party, and to Mr. L. Bernacchi and Captain Colbeck for aid in Borchgrevink's South Polar Expedition. King Edward VII has succeeded Queen Victoria as Patron of the Society.

Philippine Weather Service.—The Philippine weather service has now scattered throughout the archipelago some 20 telegraphic stations from which advance warnings of the approach of typhoons can be wired to Manila. Before the revolution of 1897 Spain had a number of similar stations located at strategic points, but when Dewey entered Manila Bay not one remained outside of the city. After the occupation of the islands by the American Government plans were at once formed by the Chief of the U. S. Weather Bureau, aided by Father Joseph Algué, S. J., to reorganize and extend the former service, and now that the pacification of the islands is nearly secured, these plans are rapidly becoming realized. The Philippine service is in charge of the Manila Observatory, with Father Algué as director. It is supported by the funds of the Philippine Government rather than those of the United States, and is independent of the U. S. Weather Bureau, but receives the active coöperation and assistance of the latter. As soon as enough of the islands have been connected by cables the U. S. Government will organize an extensive system, and the Philippine service will be incorporated under Federal direction.

GEOGRAPHIC LITERATURE

Report of the Chief of the Weather Bureau, 1899-1900. U. S. Department of Agriculture. Pp. 436. 1901.

Prof. Willis L. Moore gives a comprehensive statement of one year's work of this great scientific branch of the Government. During the year many important advances were made. A station established at Turks Island completed the chain of stations extending from the Lesser Antilles northwestward to Bermuda and the southeastern coast of the United States. Plans were formed, and have since been realized, for special storm forecasts for the North Atlantic Ocean, giving the wind force and wind direction for the first three days of the route of all outgoing steamers. Experiments were made in wireless telegraphy, and eminently satisfactory progress made in the investigation. A reduction to a homogeneous system of the barometric observations taken by the service during the past 30 years was undertaken. The total eclipse of May 28, 1900, was observed by Professors Bigelow and Abbe, at Newberry, S. C., and new information (to be published later) obtained regarding the effect of solar action upon the earth's atmosphere. Arrangements for distributing forecasts and warnings to vessels navigating the Great Lakes were so perfected that each of the 20,000 vessels that passed Detroit received the latest weather news, and also vessels leaving Chicago and the Great Lake ports. Forecasts of cold waves, of hurricanes, and of floods saved millions of property.

A valuable feature of the report are tables, prepared by Prof. A. J. Henry, giving the monthly mean, maximum, and minimum temperature, pressure, and moisture of 170 Weather Bureau stations. The meteorological observations of Evelyn B. Baldwin during the Wellman Arctic Expedition of 1898–'99 complete the report.

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